JPRS 82833

9 February 1983

West Europe Report

SCIENCE AND TECHNOLOGY

No. 137

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ELECTRONICS

WESTERN FIRMS OFFER PROHIBITED ELECTRONICS AT MOSCOW EXHIBITION

Duesseldorf HANDELSBLATT in German 14 Dec 82 p 1

[Report by sz: "COCOM List--Prohibited Articles in Moscow"]

[Text] Moscow. It appears that at Moscow's ELECTROMASH '82, which closed last weekend (the third technical exhibition on the manufacture and control of products of the electronic industry) numerous instruments containing components manufactured by Western European firms and prohibited for export to the USSR under the COCOM list for specialized technology were offered for sale. Apart from peripheral systems, component conductor panels and laser technology, some instruments are said to have been displayed which fall under the purview of the COCOM list such as certain electronic instruments and computers, as well as high-energy laser technology instruments.

HANDESLBLATT has learned that several Western ambassadors have reported the COCOM violations to their respective capitals and provided the names of the firms guilty of those violations. It is to be expected that therpe will be an aftermath for some exhibitors at this trade fair. Mention has also been made of the offices responsible for preventing the export of certain high-technology items to the USSR. These events are all the more embarrassing as they became public at a moment when efforts are being made to bring about closer coordination in Western export policies for trade with the East.

Apart from German firms, Austrian and Netherlands exhibitors are principally cited in the reports as having offered electronic components. Some firms apparently also violated United States prohibitions by selling U.S. components incorporated in European instruments, especially in electronic guidance systems.

The ELECTROMASH exhibit was unusually well attended, and Soviet foreign trade enterprises asked that it be extended by 2 days, which was, however, impossible.

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CSO: 3698/138

ELECTRONICS

THOMSON NEGOTIATES FOR ACQUISITION OF EUROTECHNIQUE

Analysis of Move

Paris ELECTRONIQUE ACTUALITES in French 12 Nov 82 pp 1, 17

[Article by JP Della Mussia]

[Text] We heard the same news from three different sources: Thomson is getting ready to acquire all of Eurotechnique, meaning not only the 51 percent belonging to St-Gobain, but the 49 percent belonging to NS (National Semiconductor) as well. NS in fact, is supposed to be currently negotiating with Thomson about license agreements regarding its MOS technologies.

Of course, nothing has yet been signed. Officially, neither Thomson nor the Ministry of Industry are confirming anything: "The less the press talks of this matter, the better." The only statement from NS is that "it does not look good," without further details.

However, the one party that is not represented in these negotiations is the components user. That is too bad, because if there is an integrated circuits plan, and if a components plan is to follow, it is in fact to help users make the best possible systems. The country's competitiveness in electronics will be demonstrated at the systems level.

In this article, we will therefore attempt to defend the user's viewpoint. For him, the solution being prepared appears to present more disadvantages than advantages with respect to the status quo.

It all began last March, when the government announced that three MOS centers in France (EFCIS, Eurotechnique, MHS) were too many (see ELECTRONIQUE ACTUALITES of 19 March 1982). The government was (and still is) ready to support an integrated circuit industry in France, but did not want to disperse its MOS budget among three companies. This was all the more understandable, because, ever since nationalization the state has had indirect partial control of MHS (through Matra), Eurotechnique (through St-Gobain), and EFCIS (through Thomson and the AEC), all at the same time. (Japan does have seven large companies which manage to balance their accounts with mass produced MOS

devices, but our technologic advancement and working conditions are very different). It immediately became apparent that a merger of the three companies was quasi-impossible. And even the union of two companies was not very likely without serious harm (see ELECTRONIQUE ACTUALITES of 23 April 1982).

In this affair, the position of the three companies involved was very different.

MHS was not interested in any merger, and to our knowledge made no proposals. The company merely examined all the proposals that it received, and demonstrated that none were advantageous for all the parties.

An Ungracious Attitude

Until July, Thomson's components branch adopted a rather ungracious attitude toward Eurotechnique: "We will accept Eurotechnique, but only if it is given to us; we will turn it into an electronic lens plant for the Thomson group." (Eurotechnique has always been considered as a potentially dangerous competitor by EFCIS).

Eurotechnique and its partner NS, on the other hand, made a number of proposals to the government. That is only normal, since 51 percent of Eurotechnique belongs to St-Gobain, and since St-Gobain is asked to withdraw from electronics: Eurotechnique's situation has to change in any case.

NS thus proposed that Eurotechnique fulfill part of its world strategy for some products, as part of an association with Thomson and/or CII-HB. In practice, as we understand it, NS proposed that Eurotechnique become the sole unit responsible for research and production of EEPROM and EPROM within NS, with NS reselling the French-manufactured products in this field, through its worldwide network. In particular, NS agreed to finance all EEPROM research at Eurotechnique to meet the needs of the entire group. It also proposed to resell through its European network the microprocessors manufactured by Eurotechnique. And finally, in case of association with Thomson, NS offered to sell through its worldwide network the bipolar integrated circuits that it does not manufacture, at well as the discrete semiconductors of Thomson-CSF. These offers were not disinterested: they made it possible to distribute development tasks at NS, increase the company's turnover by expanding its catalog, and develop innovative circuits based on new French ideas. Its penetration of the French market would thus have been better than the present one.

At the end of June, the government admitted that only a combination of Eurotechnique and EFCIS was possible, since the association of MHS with Intel and Harris was already sufficiently complex not to be complicated any further. At that point, the possibility was studied of joining the strong points of the two companies involved, namely design at Thomson-EFCIS, and mass production know-how at Eurotechnique (see ELECTRONIQUE ACTUALITES of 25 June 1982).

But this implied that NS would have to retain an interest in Eurotechnique's capital, for three reasons: first of all, only NS can provide Eurotechnique with mass production know-how for very advanced technologies; secondly, NS can give Eurotechnique masks for very many advanced technology products of worldwide interest so that the latter will not have to repeat the entire process; and lastly, NS has a well established worldwide sales network which should allow the Rousset company to mass-produce some circuits in sufficient numbers to guarantee their competitiveness on the world market.

With this in mind, Thomson associated with NS saw itself losing responsibility over too many parameters from production to sales. The military did not like it either. However, since the government was imposing a union between the two companies, Thomson sought to eliminate NS--at least partially--from Eurotechnique's capital. Toward mid-October, the government, now convinced, apparently asked NS to examine the possibility of withdrawing. (Negotiations dragged on because of changes in negotiators, in July at the Ministry of Research and Industry, and in September at the head of the components branch of Thomson-CSF).

License Agreements

But as we have seen, Eurotechnique cannot develop without NS, and is eventually condemned to die. Since EFCIS cannot replace NS for the three essential supports mentioned above (mass production know-how, masks for advanced circuits of worldwide interest, and sales network), two solutions were possible: either have Eurotechnique drop its mass production objectives, which the government does not want to do, or negotiate license agreements for some large standard memories, probably relying on Thomson's worldwide sales network for their distribution. This second solution is the one currently being negotiated.

In our opinion, this approach is against the best interests of users, because among other things, the second version of Eurotechnique will not be able to offer Eurotechnique's products at world market prices and make a profit for long enough before either a new government or Thomson decide to abandon this activity.

Until now, EFCIS has had a realistic marketing policy: at no time since its new start as part of the first integrated circuits plan did this company seek to produce memories that are overly competitive internationally. EFCIS is a company of specialized slots, and has never denied it. It mass produces only those products which it alone--or nearly alone--offers, or which meet a strategic need, either for the group or as part of a family of products. In 1981, this policy enabled it to incur only limited losses, which undoubtedly would have been profits had the circumstances been better.

Will the contribution of NS licenses change the situation? There is no reason why it should. EFCIS has manufacturing licenses from Motorola to fabricate certain standard products essential for its strategy; it could have acquired

licenses for memories, but did not do so because among other things, its worldwide sales network is not sufficiently well developed to distribute the millions of parts per month that are necessary to approach profitability in memory production.

Moreover, the frames of mind at EFCIS and Eurotechnique are very different. Their personnel is equally dynamic. But Thomson does not allow EFCIS to invest exactly as it it would liked to; the group's requirements have been very heavy so far, and demanded many resources for objectives that were not EFCIS's own; and lastly, EFCIS must use the group's network for exportations, which offers some advantages but also imposes some burdens that are difficult to conceal. In this context, it is to EFCIS's credit that it has an average annual growth in the tens of percent range.

At the same time, Eurotechnique has a turnover growth rate in the hundreds of percent, and this situation should normally continue until 1986. With such a growth, Eurotechnique had a chance of making some profits in memories at the first recovery. With "only" tens of percent in growth, the personnel and stockholders might give up before reaching their goal.

With or Without NS?

For users, is the fact that NS has 49 percent of Eurotechnique a drawback in terms of national independence? We don't believe so. On the contrary, with 49 percent of the shares, NS is interested in Eurotechnique's success; but the success of this company is also of interest to users, which find in its catalog circuits that the other French companies do not offer. From this standpoint, everyone (except competitors) has the same interest.

And what if NS were to cut off the supply of know-how? That's the danger in any joint venture. But in the case of manufacturing under license, the risk would be even greater.

NS has also proposed a division of tasks with Eurotechnique: after all, NS does take the risk of entrusting its developments to foreigners. Finally, for advantages that are quasi-nil compared to the present solution (except for pleasing Thomson, and barely at that), the French taxpayers would have to pay 100-200 million francs to thank NS, and Thomson would have to buy licenses and pay royalties to NS. In addition, Thomson would have in NS a competitor on French soil (with products having a lead of several months) instead of working in different slots. All of this so that Thomson can ultimately drop memories, as it probably will.

Only Two Centers?

If the government really wants to support only two centers, it would undoubtedly do better to concentrate its assistance on Thomson and MHS in the specialty slots that they have defined for themselves because that is where they feel competent. Nothing prevents the government from reselling the shares of St-Gobain to the Bourse de Paris (stockmarket) (or to a bank) and

discontinuing its aid to the company. This would constitute a lesser evil to users and a benefit to taxpayers. It can be counterargued that Eurotechnique has a chance to manufacture in France the custom circuits that could have been made by the national companies. But Texas Instruments, Motorola, and RTC among others (and maybe Fairchild soon), are also on the scene, and it is in the users' interest that the best man win. You certainly cannot ask Texas Instruments to withdraw from France because it makes custom circuits that could have been made by the others!

Basis for Decision Revealed

Paris ELECTRONIQUE ACTUALITES in French 3 Dec 82 p 22

[Article by JPDM]

[Text] As we indicated in our article of 12 November 1982, Thomson-CSF is getting ready to take over Eurotechnique, meaning not only the 51 percent of St-Gobain, but the 49 percent of NS as well. NS must thus sell its shares to Thomson-CSF; negotiations on this matter are currently underway.

In our issue of 12 November, we explained in some detail why we believe this to be a bad solution for component users, for Thomson-CSF, and for taxpayers as well.

Because of the number of indignant responses we have received about the indirect elimination of NS, we sought to find the origin of this decision, a rather difficult task since those involved very carefully avoid making any statements concerning this topic. From our inquiries we learned that both DIELI (Directorate of Electronics and Data Processing Industry) and electronics authorities at the Ministry of Industry favored a joint NS/Thomson-CSF company (however, they have not confirmed it). Moreover, we are sure that Thomson-CSF did not request any combination with Eurotechnique in this affair, at least at the level of the components branch of the company. On the other hand, once a combination was imposed, Thomson-CSF did not want NS as partner. The only person in the ministries, who was indicated to us as being in favor of the merger of Eurotechnique and Thomson-CSF without NS, is Mr Gallois, staff director of Mr Chevenement. The military personnel at DRET (Directorate of Research and Technological Studies) also intervened in favor of a purely national solution, but we were not informed of their position because of non-disclosure of secret guarantees furnished by NS last September.

Since our previous article, we were able to obtain further details about the proposals that NS made to the government during recent months. In particular, NS proposed (but similar ideas also existed at DIELI) that a sort of MITI be created in France, as a coordination committee responsible for rationalizing the actions of three semiconductor companies (MHS, Thomson/NS, and captive Thomson) and of the research laboratories of LETI (Electronics and Data Processing Technology Laboratory), CNET (National Center for Telecommunications Studies), and CNRS (National Center for Scientific Research).

In this plan, the present EFCIS was divided in two: one portion called Thomson/NS, oriented toward standard products and attached to Eurotechnique, to the bipolar integrated circuits division, and to the discrete semiconductors division of Thomson-CSF; and one portion oriented toward the captive needs of the Thomson group, but with the technologic know-how of Thomson/NS. NS agreed for Thomson/NS to manufacture the 6800 and 68000 microprocessor families, or any other circuit as a second source.

In sales, NS proposed that Thomson/NS have sales exclusivity for NS products in France, and that it resell all the products manufactured by Thomson/NS outside of France. However, NS and Thomson would have retained their own world marketing for all the products they would have made. And finally, the American company accepted that its participation in Thomson/NS be reduced to 35 percent.

NS estimates that profitability for Thomson/NS could have been reached within two years in MOS, within one year in bipolars, and that it would have immediately reached 5 percent after taxes in discrete devices.

Still according to NS, the turnover of Thomson/NS would have been 500 million dollars within two to three years.

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CSO: 3698/124

SGS-ATES INITIATES NEW TREND IN SEMICUSTOM CIRCUITS

Paris ELECTRONIQUE ACTUALITES in French 26 Nov 82 p 19

[Article by FG]

[Text] The introduction by SGS-ATES, at the same time as AMI (see ELECTRONIQUE ACTUALITES of 19 November) and IMP (which we will discuss in a future issue), of catalog circuits based on elementary functional blocks (converter, operational amplifier, divider, and so on) rather than standard cells, creates a new trend in the field of semicustom circuits.

The orientation of manufacturers of this type of circuits toward precharacterized devices in the broad sense of the word, confirms what we wrote last June, namely, that these types of circuits will take the lead over gate arrays (see ELECTRONIQUE ACTUALITES of 25 June) in most applications. The fabrication of integrated circuits from catalogued functional blocks, with some of them being available as custom designs, does seem to be more flexible, and allows a better utilization of the silicon area than gate arrays, without reaching the cost and development time required for purely custom circuits.

34 Catalogued Analog and Digital Blocks

Like AMI's, the SGS-ATES system, named Zodiac, calls upon analog and digital functional blocks selected as representative of the functions most frequently used in systems, but not incorporating a microprocessor. The IMP system, on the other hand, should also include a microprocessor in 1983. The Italian company can also fabricate a certain number of custom blocks. In principle, its system is intended to allow the integration of all the analog signal processing portion of a system. For quantities between 50,000 and 500,000 devices per year, it makes it possible to move from idea to mass production of circuits in an average of 40 weeks (36 to 44); 10 weeks are needed for first samples after receipt of customer drawings. SGS-ATES is currently doing the layout, but by the end of next year CAD resources should be more customer oriented.

The Zodiac catalog currently includes 34 functional blocks in MTL3V (Merged Transistor Logic Linear Low Voltage) technology derived from I2L and making it possible to integrate I2L and ECL linear functions. This otherwise rather conservative technology (6 micron lines) uses two levels of metallization, making it possible to increase the integration density (160 transistors/mm-square and/or 140 NAND with 3/mm-square leads) and to obtain circuits with areas of less than 20 mm-square. As a whole, the technology is characterized by a current density of 50 mA/square-mil, a cut-off frequency higher than 1 GHz for NPN and 20 MHz for PNP, a propagation loss time of 20 ns maximum, an average factor of merit of 1 pJ, a flip-flop frequency of 8 MHz, and a voltage of 2-10 V.

On the analog side, the catalog currently includes among other things, a programmable operational amplifier with a 6 MHz gain-band product, a 100 ns comparator, a 1.23 V voltage reference, a 6-bit 100 ns digital-analog converter, and NPN and PNP transistors; on the digital side, it includes an asynchronous modulo 256 divider, a synchronous 4-bit counter consuming 2 mW and operating at 2 MHz, NAND gates with 3 and 1 to 4 leads, and an ECL divider-by-two operating at 200 MHz.

At the end of next year, the technology should be extended to new functions with the introduction of gate arrays for the fabrication of non-catalogued elements, memories (64x4-bit RAM), sampler-blocker, 8-bit analog-digital converter, JK ECL flip-flops, and so on.

Currently, SGS is marketing a kit of 24 integrated circuits in 20-pin DIP packages, incorporating all of the catalogued blocks; it is intended to familiarize potential users with Zodiac, and to create if needed, a card prototype which will exactly model the future integrated system.

11,023
CSO: 3698/123

NEW PRODUCTS EXHIBITED IN LONDON AT 'SEMICUSTOM 82'

Paris ELECTRONIQUE ACTUALITES in French 3 Dec 82 p 23

[Article by F. Grosvalet]

[Text] London--The second international conference on semicustom circuits (Semicustom'82), held in London on 23-25 November, was equally as successful as the first one, with the participation of nearly 250 persons from 16 countries (essentially European, although some Americans and Japanese were also present). Despite this, it remains strongly stamped by the country in which it is held, and the great majority of the audience was English. That is maybe what determined its organizers to select two different locations for Semicustom'83. Next year, the conference will be held at several days' interval in Great-Britain (25-28 October) and FRG (2-4 November).

Despite this year's participation of American and Japanese companies, the absence of a certain number of European companies was noted, even though they are in the semicustom market (Siemens, Thomson-CSF, MHS, and so on). Although the topics discussed at Semicustom'82 remained as a whole, the same as last year, this year's conference was less marked by the announcement of new products.

Manufacturers seem to be much more interested in improving the interface with users rather than in expanding the range of the circuits they offer. In this respect, it is significant that over one-half of the papers presented in London were directly or indirectly related to CAD or design automation. It should nevertheless be pointed out that CMOS gate arrays of up to 10,000 gates are beginning to be almost commonly found, and that if announcements about precharacterized circuits had been rare last year, they have multiplied in the period between the two conferences, as testified by the many articles that we have written on the subject, especially in the past few weeks. Thus, of the 61 current manufacturers of gate array circuits, 15 offer precharacterized circuits or both.

The second international conference on semicustom circuits also demonstrated some innovation of form, through the organization of two additional sessions: a preliminary session intended to familiarize those who were not, with semicustom technology; and another, economic one, intended to make it possible to measure the impact of this technology on the integratd circuit market in general.

Toward Development Systems for Gate Arrays

Two overall trends for the future of gate arrays emerge from Semicustom'82. The first concerns the development of precharacterized circuits in the broadest sense of the word, at the expense of gate arrays and pure custom circuits. The second refers to the necessary automation of all the means of design, from a functional description of the circuit, to the generation of data tapes for mask fabrication, and to the simplification of the interface with users, so as to allow them to fully understand the designs of their circuits. That is why we should see an increased development in independent work stations, a sort of gate array development system, such as the ones already offered by MHS, Mikron (see our 26 November issue), or those presented in London by Mitel, Ferranti, or Plessey. The ideal in this field would be to reach the point where users could directly enter into a computer a functional description of the circuit, without needing to pass through the stage of logic diagram. The availability of such work stations should meet the needs of more than 200,000 system designers, who know perfectly well what they want to integrate on silicon, but who presently do not have the means to do it. Another solution in this area could be provided by silicon compilers, which like compilers in computers will allow designers to use a high-level language to describe their circuits without needing to know machine codes, and to translate these descriptions into interconnection drawings. Such compilers already exist, and were presented in London (see ELECTRONIQUE ACTUALITES of 24 September 1982).

40 Percent of the 1992 Semicustom Market for Precharacterized Circuits

While gate arrays now hold essentially the entire semicustom market, and while this situation should persist until 1985 (for the time being they represent the least costly approach for small quantities), precharacterized circuits should undergo a very strong growth from then on, and represent 40 percent of the market in 1992. This growth, primarily at the expense of gate arrays, should continue afterwards.

In the area of precharacterized circuits, the future seems to belong to catalogs of functional blocks of variable sizes, combining digital and analog features, including 16-bit microprocessors, and 64 K ROM's and RAM's. More and more manufacturers are offering such circuits; among them are AMI, SGS-ATES, IMP, CDI, and ZyMOS.

According to Strategic Incorporated, which relies on SIA figures and whose results are corroborated by those of other companies, semicustom circuits currently represent about 30 percent of the non-Japanese market of custom circuits (250 million dollars out of 870 million). This situation should reverse by 1992, at which time pure custom circuits will represent no more than about 20 percent of a market which would exceed 16 billion dollars; semicustom circuits would then reach 13 billion dollars (7800 million for gate arrays, and 5200 million for precharacterized circuits).

In technologies, it appears according to several studies that the CMOS technology which presently predominates (of the 61 manufacturers of gate arrays, 52 offer CMOS), will still predominate at least until 1992. It currently represents 60 percent of the gate array market, should go to 65-70 percent in 1985-1986, and drop back to 60 percent thereafter. ECL's part should remain 10-15 percent during the next 10 years, and that of linear bipolars 20 percent, with the other categories of bipolars tending to disappear. The first commercial GaAs gate arrays should also emerge in 1992.

According to CDI and LSI Logic, the circuit complexity average should become about 5000 gates in 1985, with circuits of 20,000 to 50,000 gates by 1992 for applications in the telecommunications and data processing areas.

11,023
CSO: 3698/123

ELECTRONICS

GOVERNMENT AID TO DP INDUSTRY JUDGED USEFUL BUT INSUFFICIENT

Duesseldorf VDI NACHRICHTEN in German 8 Oct 82 p 2

> [Text] Early in September, a study group, by direction of the Federal Research Ministry, submitted a study which indicates that government support for the German data processing industry was, to be sure, useful but was insufficient to guarantee the enterprises that were supported a meaningful position on the world market. The members of the Lower House Committee on Research and Technology have criticized this report. They maintain that it is in error and that, instead of the German enterprises thus assisted, data from foreign offerors were also included in the report.

Experts on the data processing scene will remember this: on 26 September 1979 and on 10 October 1979, the Committee on Research and Technology of the German Lower House questioned experts from industry, science, and government in a closed-door and an open hearing as to their estimate of the results of a more than 10-year old data processing assistance effort. Almost unanimously, the experts were of the opinion that government financial aid was very helpful. In the light of American but especially Japanese competition, one could however not do without more West German government funds.

Impressed by this report from the experts, the Committee on Research and Technology in 1980 urged the federal government--because of the initial effect springing from information techniques and their key role for the entire economy of the FRG--to continue aid to microelectronics, data processing, and technical communication in a stepped-up fashion. But there was no response from the Research Administration and probably was not to be expected anyway in view of the fact that funds were getting to be increasingly short.

Market Researchers Called In

Not until June 1981 did the CDU/CSU [Christian Democratic Union-Christian Social Union] take up this topic upon the urging of Lower House and Technology Committee Member Erich Maass; not until then did it draft a motion which, on 10 December 1981, was passed without opposition in the German Lower House. In this way, the federal government was obligated to provide information

as to the market value--in its view--of the German data processing industry and whom the aid programs really helped.

During its deliberations, the Committee on Research and Technology was informed that the Federal Ministry of Research and Technology already at the beginning of the year had directed the study team of the SRI (Stanford Research Institute) and the ADL (Arthur D. Little) enterprise to prepare a "Program Analysis of Data Processing Assistance during the Years 1967-1979." In addition to the former subsidy recipients, project managers, and experts, the study group also intended to question several members of the Committee on Research and Technology who were particularly concerned with data processing matters.

Statistics That Tell Little

Some members of the Committee on Research and Technology thought it rather odd that, of all things, parliament, as a supervisory body, was to be questioned as to what the situation with the data processing assistance programs was because, after all, it should have been first of all the federal government that would have had to comment by virtue of its responsibility. But the action of the study group during its questioning phase, which also included IBM, was even stranger. In its contact letter designed to prepare and carry out this drive, it pointed out, in describing its mission, that the idea was to determine "to what extent the federal government and especially the Federal Ministry of Research and Technology were successful in attaining the goals of providing assistance to the manufacturers, users, and in science through the assistance measures spelled out in the three data processing programs."

The Committee on Research and Technology has since April of this year had the report from the federal government concerning assistance to research and development in the fields of data processing and information techniques; since 7 September, it has had the expert report from the study group of the SRI and the ADL which originally was promised for the first quarter of 1982.

During the 8 September 1982 committee meeting, the parliamentary state secretary first of all had to accept harsh criticism from Erich Maass on the federal government report. According to Maass, one might simply, in amusement, skip over the fact that the federal government gave the output volume of the German data processing industry at DM6.9 million (DM6.9 billion would be more accurate) or gives the Lower House the idea that the data processing and office machine industry employs only a little more than 8,000 persons (ten times that figure would be more correct). Far more serious than these oversights however is the fact that numbers and statistics were submitted to the Lower House which cannot be used to determine what the House wanted to know. In justifying his charges, he mentioned the following, among other things:

The Lower House wanted to know about the situation of the German data processing industry to learn whether and how government subsidies affected that industry. The federal government however released figures on the data processing industry in the FRG which also include output, import, export,

and employee figures for companies not assisted, such as IBM or NCR. One cannot tell from the report whether and to what extent the predominance of American companies, which existed at the start of West German government assistance efforts, changed. The employee figures given in the report cover only the technical and commercial employees but not persons employed in sales and in the administration of that industry.

Sales Were Forgotten

It is especially necessary to include those persons who are active in sales because it is not only the quality of the product but even more so the quality of sales that is responsible for the success of an enterprise. By the way, the impression is created that the German data processing industry is a constantly growing industry which however is not so if one corrects the statistics by eliminating the figures for the affiliates of foreign firms. Besides, the report lacked any indication whatsoever as to whether the domestic market or also the EC market is enough to enable German firms to survive. A breakdown of the sales volumes of "German" enterprises at home and in other markets could have provided information on that. Finally, the report lacks any reference as to the structure of the German data processing industry, especially on the order of magnitude of the German enterprises active in certain specific data processing sectors, as well as on the foreign trade relations of the German data processing industry with technologically leading countries, such as the United States and Japan.

Additional Initiatives Necessary

In the course of the discussion, Parliamentary State Secretary Erwin Stahl also had to accept some unpleasant questions from the ranks of what then was the SPD/FDP [Social Democratic Party, Germany-Free Democratic Party] coalition fraction. With the help of the boss of the SPD fraction, Dr Ulrich Steger, the boss and deputy chairman of the Committee on Research and Technology, Professor Dr Karl-Hans Laermann, wanted to know whether data available to him were accurate to the effect that the expert report of the SRI and ADL study group submitted to him is not the original version but a "sanitized"version in which, compared to the first one, the negative comments and judgments on the three aid programs were considerably mitigated. This is why it was demanded in the name of the coalition fractions that the so-called "original version" be made available to the committee. State Secretary Stahl denied such assertions with indignation. He maintained that there is no "original version," that the expert report submitted does express the result determined by the DRI and ADL study group. This is why he could not make a paper available to the committee that did not exist.

The committee did have to be satisfied with that information. It is neither an investigating committee, nor can it mete out any penalties, assuming there were such an obligation to submit such reports to it in the first place.

It therefore remains to be hoped that the committee will also think about what is to happen now. The purpose and effect of government subsidies will play a decisive role here. As Deputy Erich Maass put it: Government subsidies produce neither ideas, nor markets."

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CSO: 3698/153

ELECTRONICS

RESEARCHERS REACH SEMICONDUCTOR MANUFACTURING LIMITS

Duesseldorf VDI NACHRICHTEN in German 8 Oct 82 p 13

[Article by Claus Reuber: "Researchers Reach Production Limit"]

> [Text] Semiconductor components reveal structures with a length of 0.3 μm. Because of the increasing number of functions, semiconductor components assume ever smaller dimensions in a small silicon chip in order to reveal ever shorter switching times; this is why researchers in the laboratories are looking for new ways to make these precision structures on the raw [working] materials. During the 12th European Conference on Solid Body Component Research in the middle of September in Munich, report presenters showed how these precision structures can be implemented by means of x-ray lithography and synchrotron rays.

In Auditorium A of the Munich Technical University, M. P. Lepselter of Bell Labs, New Jersey, United States, presented to his audience first of all a slide showing static reading storage unit (Ram) with a capacity of 4,096 byte, which, using the methods of x-ray lithography, had been placed on a surface of only 1.4 x 1.4 mm^2 [illegible in photostat]. This submicrometer structure provides an access time on the order of 3 ns; in it, the electrons move at a saturation velocity of almost 10^7 cm/sec, which signifies a time of 10 ps per micrometer.

Lepselter considers x-ray lithography to be the only way to achieve micrometer and submicrometer structures in integrated semiconductor circuits (IC). He uses an x-ray tube with a 2.3 keV acceleration voltage and a palladium target which gives off a main wavelength of 0.44 nm. At an operating output of 4 kw, he requires exposure times of definitely less than 1 minute for 3-in wafers. The term "wafer" is used in referring to the effective substance disk which later on displays the desired structures. Wafer adjustment can be accomplished either by hand or later on also automatically. Here he achieves positioning results which are accurate down to 0.05 μm. The machine developed in his laboratory reportedly costs about $100,000.

The masks used by him for x-ray lithography consist of a carrier layer of 6 μm boric nitride with structural patterns in gold or tantalum with a

thickness of 600 nm or 100 nm. The decisive aspect in his method is the level [smooth] configuration of the special photoresistor which he does not apply directly but on a surface of the wafer which is leveled off [flattened] with an intermediate layer.

In this technology we get Mos structures with a gate length of 0.7-1.2 μm; because of the overlaps of the gate electrode with the source and drain, this leads to channel lengths of 0.3-0.8 μm. Another thing that is important in this technology is the selection of the silicide on the polycrystalline for the reduction of the feed resistances. As was observed elsewhere, titanium-silicide here seems to produce the lowest resistances.

The Mos structures thus produced work at an operating voltage of about 2 v; higher voltages do not lead to an avalanche breakthrough but, in view of the short channel length, they lead to function as lateral transistor. Lepselter achieved a big success when, toward the end of his lecture, at the 12th European Conference on Research in the Area of Solid Body Components (Essderc 82), in Munich, he presented his "5-GHz tie clasp," a tie clasp with an IC suitable for 5 GHz.

Prof A. Heuberger of the Fraunhofer Society in Munich pursues x-ray lithography not with the relatively weak x-ray source from a special x-ray tube, such as Lepselter, but rather with the high x-ray intensity coming from the synchrotron. This is why he does not need any special x-ray resistor and no multi-layer resistor structure but rather quite normal resistor materials. Synchrotron radiation reaches an intensity of 10^{-1} W/cm^2, the x-ray tube comes to about 10^{-3} W/cm^2 [illegible in photostat], and a plasma source, likewise discussed for these purposes, comes up to 10^{-2} W/cm^2. Among the other, quite different data from the three sources, we might also mention here the intervals between the radiation source and the mask. In the case of the synchrotron source, the interval is about 10 m; for x-ray tubes it is only about 30 cm and for the plasma sources it is more than 50 cm.

Synchrotron Rays for Production

Heuberger employs an interval of about 40 μm between the x-ray mask and the wafer. His mask consists of a kapton or beryllium carrier and the about 0.5-μm thick structure made of gold or platinum. The 1.5-GeV synchrotron radiation proved too good for lithography. It does not create any problems upon the heating and thus deformation of the exposure masks. A mathematical estimate of the attainable resolution shows that the 1.5-GeV radiation produces perfectly rectangular structures in the resistor. It was also possible to prove this experimentally on extremely thick layers, for which plexiglass is particularly good. In layers which are several micrometers thick, structural details of just a few micrometers are still perfectly resolved and, besides, the edges are perfectly perpendicular.

Heuberger pointed out that big research synchrotrons of course are not suitable for industrial production but that it is expected that a storage ring will be available for the purposes of the IC industry by 1985. It is supposed to

produce a radiation with a main wavelength of 2 nm and, with its supraline magnets for the circular path of the electrons, it is supposed to weigh no more than 10 t. In it, the electrons are supposed to be able to circle [rotate] over a period of 20 hours and to give off radiation before new ones must be fired into the storage ring. According to Heuberger, such a system would seem to cost no more than DM5 million although it must be kept in mind that it can produce five to ten rays for exposure purposes so that the cost per ray would not be more than DM500,000.

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CSO: 3698/153

BRIEFS

FRENCH MICROLITHOGRAPHY TECHNOLOGY--Jean-Pierre Chevenement got angry: "The microlithography of the Thomson group will be carried out in its laboratories of Corbeville, near Paris." The minister of research and industry thus cancels the decision taken by Thomson (whose artificial aspect has been pointed out) to discontinue the activities of its Cameca subsidiary in the area of equipment for integrated circuit manufacturing. For several years, the subsidiary had been conducting R&D on microlithography equipment (engravers, maskers, step and repeat cameras), but out of habit, Thomson was probably waiting for a reserved monopoly and subventions before moving to an industrial stage. During this time, relying on the government, Matra was signing in the same field, a cooperation agreement with the American company GCA (see 01 HEBDO No 719). It also reopened the question of the projects formulated by the departments of the Ministry of Research and Industry. Reasserting--at the risk of offending the office of the Prime Minister--that he intends to remain in charge of defining industrial policy, and that the enterprises must cease their "harmful rivalries," Jean-Pierre Chevenement concluded: "Within one month, a means for technical, financial and commercial cooperation will have to be found among the French industrialists and laboratories involved, this solution to take the form of a national project." [Text] [Paris ZERO UN INFORMATIQUE HEBDO in French 2 Nov 82 p 1] 11,023

COAL LIQUEFACTION--Since November 1981, the coal-oil plant, operated by Ruhrkohle Cel und Gas GmbH [company with limited liability] jointly with Veba Oel AG [Incorporated] in Bottrop, has liquefied 16,000 t of coal. As part of its current trial run, the plant has been in operation without interruption for 1,100 hours since 27 July. More than 6,500 t of coal were put through during this experiment. The plant was erected as what at that time was the biggest coal liquefaction experimental plant for Europe and, after 2 years of construction, it was opened for operation in July 1981. The first coal was hydrogenated already at the end of November 1981. Since then, about

16,000 t of coal have been liquefied. The coal oil is processed into fuel at the Ruhr plant of Veba Oel AG. The Bottrop coal-oil plant, which is being helped along by the minister of economy, middle class, and transportation of the State of North Rhine-Westphalia, continues its current experiment without interruption, with the goal of further optimizing the process phases. [Text] [Duesseldorf VDI NACHRICHTEN in German 8 Oct 82 p 10] 5058

FIFTH-GENERATION COMPUTER--French authorities have discussed with considerable restraint a Japanese invitation to cooperate on plans to develop the so-called "fifth generation" of computers. According to the periodical, NEW SCIENTIST, a spokesman for the French Ministry of Industrial Affairs said the government is concerned that an exchange of information might be to the exclusive advantage of the Japanese. For this reason, the French have appointed a group of experts to study the Japanese invitation. According to the same source, French authorities will soon decide the extent to which they will finance a purely national research program in order to offset the Japanese in this area. The Japanese Ministry of International Trade and Industry has plans to use the equivalent of 200 million English pounds (around 2.3 billion kroner). [Text] [Oslo POLYTEKNISK REVY in Norwegian Oct 82 p 39] 6578

CSO: 3698/163

SYMPOSIUM FEATURES APPLICATIONS OF SEEING ROBOTS

Paris L'USINE NOUVELLE in French 16 Dec 82 p 80

[Article by Michel Defaux: "Robotics. Vision Systems: Many Potential Applications"]

> [Text] Digital display verification, surface condition inspection, parts measurement, assembly and welding robot control, etc. There is no lack of applications for vision and image-processing systems. They must now come out of the lab and go to the industry.

Industrial applications for vision and image-processing systems are making a slow start. There are several reasons for this: their cost may still be high (although systems can be found on the market for 245,000 francs) and there are few showcase applications, especially in quality control, that would encourage manufacturers to invest in this field. The second International Symposium on Vision which just took place in Stuttgart reflected this trend: few individual enterprise cases, but many papers devoted to vision research performed by various laboratories in the world.

The applications presented fall into two major categories: inspection operations of all types (presence control, surface condition, non-destructive control, etc.) and industrial robot control (loading-unloading, palletization, assembly, deburring, joint inspection). The simpler applications involve the detection of the presence or absence of certain components. One example is the verification of digital display systems: the device makes sure that the right digit "segments" are correctly lit and that the desired operating sequence is used. It takes approximately 0.2-0.3 second to check each display. For his part, Alan Doerr, head of Automatix International France, was presenting an application involving the inspection of parts coming out of a punching press. "Developments in image-processing systems and progress in data-processing are opening new prospects for quality control," according to W. Jentner, engineer at the Stuttgart Institute for Production and Automation. One of the tasks presented was the inspection of piston rings: with vision, it is possible to detect holes, sand inclusions (from 0.3 to 0.75 mm) and grinding marks (from 0.1 to 0.2 mm). We should also mention printed circuits inspection and dimensional checking during the cold or hot forming of tubes 200-1,000 mm in diameter with tolerances of 2-6 mm. The measurement takes no more than five seconds.

Still in control (non-destructive control this time), an industrial robot is used to present a part to a video camera. The system designed by Interflux (FRG) can be used to inspect steering ball-joint assemblies. They are magnetized and sprayed with a fluorescent liquid containing magnetic particles. Flaws and cracks can easily be detected in a dark room, under ultraviolet light.

The robot, which is equipped with a proximity-effect sensor, now goes and takes the part from the mechanical loader, presents it to the magnetizing source, the spraying device and the video camera. As the robot rotates the part in front of the camera and of the two ultraviolet lamps, the part surface is analyzed line by line. A crack then appears as a succession of light points (this inspection takes only a few seconds).

A Large Application Sector For Tomorrow: Industrial Robot Control

The second large group of vision applications is the control of industrial robots, one of the large application sectors of tomorrow, if we are to believe the experts. The data supplied by the vision system bring about a change in the tasks of the robot and become indispensable whenever manufacturers orient themselves toward fully automated processes. One example in pallet unloading: the vision system tells the robot where the first part and the following parts are located. If they have not moved, the robot is thus spared useless cycles.

In assembling, the vision system ensures the recognition and inspection of the parts to be assembled and tells the robot where they are and how they are oriented. One such system, the Adaptable Program Assembly System (APAS) was presented by Westinghouse: two Olivetti Sigma 3 robots, each with a TV camera, assemble electromechanical relays using parts presented to them in a random order. The last word is the joint inspection system that enables the robot to change its path.

Some processes require two operations (measurement and welding), others work in real time: a laser beam is reflected by the surfaces to be welded and the image is observed by a camera.

Before too long, systems available on the market will also change the characteristics of arc-welding, adapting themselves to variations in joint breadth and depth. This will require additional software development.

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CSO: 3698/173

FLEXIBLE WORKSHOPS OPERATING AT SURFACE TREATMENT PLANTS

Paris L'USINE NOUVELLE in French 2 Dec 82 pp 111-113

[Article by Pierre Laperrousaz: "Surface Treatment Plant. Flexibility and Variable Optimization"]

> [Text] Coming last in the manufacturing process, the surface treatment plant must be flexible enough to adapt itself to production variations. One solution is widely accepted: the parts are processed in random order and line operation is optimized by mixing sequences of operation.

The flexible workshop is a popular subject, especially in mechanics. Yet, that very concept has been applied for quite a long time in surface treatment plants. Two facilities started in the past 12 months are witness to that: one is at Legrand in Limoges, the other at SNIAS [National Industrial Aerospace Company (Aerospatiale)] in Saint-Nazaire. They operate according to the two basic principles of flexible workshops: the loads (bars or barrels) which are to receive different treatments reach the beginning of the line in random order and are held up in storage. From there, they are fed into the line in an order determined by the system so as to ensure maximum output. This is called integral mixing.

At Legrand, the plant has been in service since November 1981; it consists of a line of mixed barrels (copper, nickel, tin, silver and brass--79 stations in all) which can follow 40 different sequences of operations. It is piloted by a Siemens PR 330 R10 computer. Every time a barrel is fed into the line, it determines the order of admission of the next three barrels, depending on tank availability and on the treatment sequences of all the barrels in the input storage (on which a ceiling is placed for reasons of space). "Usually, the computer works with 30 barrels, but that number can increase to 50, the maximum storage capacity, late in the day," according to Etienne Tourneux, in charge of surface treatments at Legrand.

In addition to optimizing line operation by mixing barrels, the system also considerably increases the effective time in operation. Thus, thanks to the input storage, the line starts working at 6 am, although the operator comes in only at 8. Similarly, thanks to the output storage (which happens to be

the same as the input storage), the line empties itself late in the day after he has gone home. As a result, it operates 11 hours (soon 13, it is hoped) whereas the operator is there only 7-1/2 hours.

The parts to be treated—small electric equipment components—are shipped to the plant in standard containers. The operator enters the parts reference (which is marked on the container) through a keyboard. But this will soon be done by optical reading of a bar code label. In the computer memory, the reference number is matched with a treatment sequence, the number of containers to be emptied in a single barrel, and the total weight and surface area of the parts. These data are displayed on a display unit so the operator can weigh the parts. This is done in a hopper placed on a scale, and any deviation from the optimum load in excess of 5 percent is indicated by the computer on a display unit. The parts are then transferred into the barrel through a vibrating chute. Finally, the barrel is closed and validated. From then on, the whole process is automated: transfer into storage, transfer into the line, return to storage after going through the tanks. The line treats from 100 to 110 barrels in a 7-1/2 hour shift and, on the average, 10 to 15 sequences of operations are used every day.

At any time, it is possible to use a display station to know how many barrels are in the input and output storage (barrel address, content, sequence of operations, etc.), the location of the barrels being processed (station number, remaining time on line, etc.). "The latter information is quite useful to keep track of a particular barrel and recover it at the end of the line before it is sent to storage," Etienne Tourneux said. For the system to be complete, the computer would only have to edit historical and statistical management reports: weight of parts treated per category, weight of metal deposited, amperes used, etc. This will soon become possible.

The facility was built by Schering and consists of two parallel lines with a dry transfer station. There are three carriages per line, two elevators and one coordinated carriage for storage management. Legrand chose the German manufacturer both because of its computer-controlled system and for the solutions it offered to reduce rinse-water consumption. In fact, the line is equipped with the Vacu-jet system which was specially designed to rinse barrels (instead of rinsing them through immersion, the electrolyte they still contain is first aspired and recovered). Water consumption was reduced to 12 liters/square meter treated (180 square meters per hour); as a comparison, the standard set by regulations is 20 liters/square meter. In addition, the parts are dried in the barrels by a process developed by the same manufacturer, and they do not have to be transferred to a dryer, which would involve a disruption of the automated process.

Mixed Computer Operation at Saint-Nazaire

The surface treatment plant of Aerospatiale at Saint-Nazaire was placed in service in June 1982; it is not as "advanced" with respect to optimization. The computer can choose from only up to four bars--but the system is just as flexible. It must accept many small series of 10 to 20 parts each, made of light alloys, and that are to undergo one of 19 possible sequences of operations falling into 3 broad treatment categories: cleaning before welding,

preparation for painting, crack detection. The line consists of 26 tanks (8 x 1 m) distributed over two lines serviced by two carriages and one transfer bridge. It is used to treat components of an Airbus A300/A310 fuselage section representing approximately 15,000 parts per aircraft, from an 8-m long panel to a simple washer! Now, the present program provides for four Airbus per month. "We never know ahead of time what we shall have to treat the next day, so that we cannot work in batches," Mr Augereau, who is in charge of manufacturing methods, told us.

The brain of the system is a Solar 16-40 computer coupled with a TS-80 programmable controller from La Telemecanique. The former is in charge of sequencing (determining the order of input of the loading hoists, following a Patapon algorithm developed by Sodeteg-TAI [expansion unknown]) and editing the various working documents. The latter controls the process (transfer of movable elements, etc.) following instructions given by the former. The system can be disconnected and a priority bar introduced by the operator who can obtain the line workload schedule from the computer. Before automation, the system required the presence of eight operators; it now operates with only two: one calls in treatment sequences (from the computer memory) every time a new loading hoist arrives, and validates them after they have been accepted by the computer; the other loads the hoists onto the line manually. The average treatment cycle was increased from two to five days [as published], compared with manual operation, and the system also guarantees a better quality since the times of immersion in the baths are strictly adhered to.

We could also mention other examples of integrally mixed surface treatment chains. Schering has supplied several to the printed circuit industry (RTC [expansion unknown] in Evreux for instance), the spectacle industry (Anger in Austria), etc. For almost four years now, a nickel-chromium line (on steel and zamak) has been in operation at Vachette in Troyes. It was installed by Walberg and is piloted by a PB6 Merlin-Gerin programmable controller achieving optimization at 80 stations (20 storage station and 60 work stations), with 15 treatment sequences.

Although there is no doubt that all these facilities have achieved one of their major objectives, namely flexibility, the optimization level achieved is questionable. In a truly optimized line, nearly all tanks would be full all the time.

This, of course, is unthinkable! "Actually, to evaluate the degree of optimization of a system, you must look at the computer program," a French equipment manufacturer told us.

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CSO: 3698/147

'NEW LOOK' OF MACHINE-TOOL INDUSTRY ASSESSED

Paris L'USINE NOUVELLE in French 2 Dec 82 pp 77-78

[Article by Georges Le Gall: "The New Look of the Machine-Tool Industry"]

> [Text] The right side of the coin: the restructuring of the French machine-tool industry is making progress and massive investments are scheduled for 1983-1985. The wrong side: the crisis has hit hard, creating havoc in workloads and causing massive layoffs. However, there is no real solution but to go on with the regrouping, and a private pole is likely to form itself next to CGMO [General Machine-Tool Company].

One year after his predecessor, Pierre Dreyfus, had the Council of Ministers approve the machine-tool development program, Jean-Pierre Chevenement, minister of research and industry, is about to draw the first balance. It is "positive as a whole."

The program provided for some restructuring: it was carried out in three instances, is likely to be carried out very soon in four others, and two or three more are contemplated (see Table). These operations involve a total of some 20 enterprises providing about half the jobs in all the industry. About 12 state-enterprise agreements have also been signed, either with regrouped companies or with companies that remained independent. They will result in very high investments in 1983-1985.

This is the good side of the question. But it would be ridiculous to pretend that it does not have a bad side. In all countries, the machine-tool markets are suffering from the crisis. The nominal market decline during the first half of 1982, compared with the same period in 1981 (not taking inflation into account) was 4 percent in Italy, 10 percent in Germany and 12 percent in Japan. It is significant to note that, although they are the leading world producers and exporters in this field, Japanese manufacturers--who are offering rebates of 30-50 percent on their regular prices--have a stock of 7,000 numerical-control machines in the United States, including 4,000 machining centers!

France has not been spared: production in 1982 (-5 percent in current francs during the first half year) reached its lowest point since 1974; during the first 9 months, domestic orders--still in current francs--increased by only 12 percent (in spite of large contracts with the Ministry of National Education) and foreign orders declined by 20 percent. The prospects for 1983, whether for production or for employment, are not very good!

Very few enterprises can look forward to an increase in their activity next year. One exception is Muller & Pesant which estimates that its sales will reach 100 million francs, compared with 80 million in 1982; this is easy to explain: this enterprise just started marketing inexpensive lathes designed for the small and medium-size enterprises which are looking for simple numerical-control machines, a field in which French enterprises have not beer very active until now.

The overall outlook is bleak: one year ago, the development program was forecasting a renewed expansion of the machine-tool industry as early as 1983, due to an anticipated increase of over 50 percent in the number of numerical-control machine-tools produced. Once again, the authorities showed excessive optimism, and it is now assumed that recovery will take place in 1984. On 30 June 1982, the number of jobs provided by the metals machine-tool industry had dropped to 18,000, i.e. 6 percent less than one year before. It will not help to look away: the number of jobs is going to decline further; anticipated retirements have already been programmed and will take effect in the next few months: at French Heavy Machines (MFL), Ernault-Somua, Cazeneuve-Ramo... And the future of enterprises which have filed for bankruptcy, like Promat-Dufour, remains uncertain.

All in all, the assumption that there will be little more than 15,000 jobs left in the machine-tool industry by mid-1983 is unfortunately not unreasonable. And the truth is that manufacturers are also contemplating reductions in working hours. In spite of the President of the Republic's exhortations, French industrialists do not invest much, and manufacturers of durable goods --including machine-tool manufacturers--unavoidably suffer from it.

The climate in which the restructuring is taking place is morose. Nevertheless, the restructuring calls for several remarks. It has often been said recently that personal rivalries had prevented desirable cooperation between family enterprises. It is true. But the large groups themselves were not very cooperative either when they controlled several of the enterprises which have now been restructured: Berthiez was controlled by SNECMA [National Aircraft Engine Study and Manufacturing Company], Forest by IDI [expansion unknown], Hure by Suez, Graffenstaden by CIT-Alcatel-CGE, Ernault-Somua by Empain-Schneider. The only enterprises connected with large groups and not affected by restructuring belong to the automobile sector: Renault (although the authorities would very much like to see Clichy Constructions, a Renault subsidiary, take over Gendron) and Citroen. As for the management of Manurhin (in which MATRA [Mechanics, Aviation and Traction Company] has a minority although leading interest, as it holds 34 percent of the stock), they have decided to take some more time before determining, in 1983, their policy with respect to the Manurhin Automatic lathes and the Sagita folding presses.

Legally, there is no nationalization in the machine-tool industry. In fact, it is not quite so since the nine shareholders of MFL, in addition to IDI and with the exception of Peugeot, are groups which have been nationalized recently or a long time ago; and the shareholders of CGMO, Suez and CIT-Alcatel-CGE, are also nationalized groups.

In the stock-removal field, apart from MFL, there remains only one heavy equipment enterprise, Sculfort; but it is almost certain that the agreement between Sculfort and the Ministry of Research and Industry will provide for the progressive disengagement of the present shareholder, Sciaky, to be replaced by public capital.

The Spiertz-Bret rapprochement completed concentration in the heavy presses sector. On this occasion, Bret will receive credits amounting to 13 million francs (7 as participation loans, 1 as industrial policy credits, 1 as guaranteed obligations, 4 as unsecured bank credits); before that, Spiertz had received 8 million francs in public credits. Spiertz will specialize in hot forging, cold stamping, extrusion and rapid cutting; Bret in automobile bodies, hydraulics and plastics. Automation components will be standardized and the two enterprises will look for foreign markets for their production in excess of their own needs.

CGMO: Close to 2,700 Jobs

The American company Gulf and Western, which owns the other manufacturer of large presses, Bliss, decided last May to discontinue its operations in France. However, with the help of Gulf and Western (and with no help from French authorities), the 170 employed by the enterprise have created and are now holding the stock of the New Mechanical Construction Company of Burgundy. They intend to face competition with the following sales breakdown: 40 percent from new presses under a Bliss license, 20 percent from aircraft arresting gear (also under a Bliss license), 30 percent from press renovations, and 10 percent from subcontracting.

The agreement signed by the ministry and CGMO, which began by regrouping Hure and Graffenstaden, already provides for an influx of 1 billion francs in new funds (375 million to be supplied by shareholders), which will enable the company to make massive investments in 1983-1985. Additional resources will also be provided at the time of the forthcoming merger between Ernault-Somua and CGMO. The total number of jobs could be around 2,700 (including, it is true, 300 in the "gears" division of Graffenstaden) if the new group includes the subsidiary (200 jobs) created by Ernault-Somua and the Japanese manufacturer Toyoda. However, this subsidiary might be taken over by Toyoda, which has made an offer to the French government. At any rate, CGMO is about to become, with Renault, the first French machine-tool manufacturer and the leading manufacturer of lathes, milling machines, machining centers and flexible workshops.

With the exception of grinding machines (Renault is reluctant to see Clichy Constructions take over Gendron since, for reasons of profitability, concentration would take place on the more modern site of Bobigny), the other major regroupings which are likely to take place also involve lathes, milling machines and machining centers.

Dufour's personnel and the Montreuil municipality have declined the offer to have Vernier take over Dufour; however, by refusing Dufour any orders from the Ministry of National Education, the Ministry of Research and Industry has taken a clear stand: if the Dufour plant is not taken over by Vernier, it will have to close. On the other hand, still for milling machines, it is practically certain that Gambin will be taken over by Alcera. Also, the rapprochement between Cazeneuve, a leader in the field of lathes, and Ramo, also a lathe manufacturer, will take place within the next two months. A new dossier is under study since it was decided that Mechanical Innovations (which signed a separate agreement with the Ministry of Industry) would not be part of this regrouping.

In spite of the regroupings already completed or about to be completed, machine-tool professionals acknowledge that it is unlikely that all manufacturers of lathes, milling machines and machining centers could survive very long if they remained independent. Therefore, it is quite probable that a second state of restructuring will take place in the next few years. And that a private pole will be created and coexist with publicly-funded CGMO.

A Summary of Regroupings

Already Decided

1. Heavy Lathes and Milling Machines

- Holding: French Heavy Machines (MFL), in which IDI has a 35 percent interest, the remaining 65 percent being held by nine enterprises: Alsthom-Atlantique, Dassault, Empain-Schneider, Peugeot, Renault, SACILOR [expansion unknown], SNECMA, SNIAS [National Industrial Aerospace Co. (Aerospatiale)], USINOR [Northern France Steelmaking Union].
- Chairman of the board: Louis Tardy.
- Two subsidiaries: Bertiez Saint-Etienne (BS), Forest-Line (FL).

2. Lathes, Milling Machines, Machining Centers, Flexible Workshops

- Holding: General Machine-Tool Company (CGMO), in which Suez Financial Company and CIT-Alcatel respectively have a 51 percent and a 49 percent interest.
- Chairman of the board: Jean-Thomas Mandula.
- Three subsidiaries: Hure, Graffenstaden, Ernault-Somua.

3. Heavy Presses

- Holding: the shareholders will be Spiertz, Bret, IDI, etc.
- Chariman of the board: Guy Wolf.
- Two subsidiaries: Spiertz, Bret.

Probable

4. Lathes: Cazeneuve-Ramo.

5. Milling Machines and Machining Centers: Alcera-Gambin.

6. Milling Machines and Machining Centers: Vernier-Dufour.

7. Forming: Picot-Bombled.

Contemplated

8. Grinding Machines: Clichy Constructions-Gendron.

9. Forming: Promecam-Colly.

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COS: 3698/146

ROBOTS PLAY GROWING ROLE IN FRG AUTO, OTHER INDUSTRIES

Munich SUEDDEUTSCHE ZEITUNG supplement in German 29 Nov 82 pp IX, X

[Article by Felix Spiess: "BMW and the Robots: New Techniques for More Humane Working Conditions"]

> [Text] With the start up of production of the new Model-3 at BMW in Munich, most of the long-term welders in the body department laid down their welding arcs. Robots took over the often difficult and monotonous work. The manipulators equippped with micro-processors work more diligently and accurately than human workers and have, in addition, the further advantage of being easier to convert to the new requirements at model changeover than conventional automated assembly lines. However, there is another side to this coin: What happens to the welders displaced by the robots?

With the new Model-3, BMW is not just bringing fresh, attractive automobiles to the market. Since the start of production at the beginning of September, unfamiliar "workers" never seen before in such numbers have been at work on the Munich assembly lines. For body framing, BMW is relying largely on robots for the first time. Nine-tenths of all chassis welding operations have been taken over by the two-meter-tall, giraffe-necked monsters: With a precision and, above all, endurance which cannot be matched by the welders who previously did 60 to 70 percent of the work, they set one after the other the many welds which hold a chassis together.

286 Industrial Robots

BMW is presently employing exactly 286 industrial robots; in 1979 the number was only 22. But it is not just the tradition-oriented, white and blue [Bavarian] company that is depending on the computer-controlled industrial robots. Other production chiefs in the industry are gaining respect for the new-fangled machines which can be freely programmed about several--up to five or six--axles, are usually electrically--but sometimes pneumatically or hydraulically--driven and can handle either a tool or a part. For one thing, in spite of the growing unemployment in the FRG, it is becoming more and more difficult to find workers for hard, monotonous or health-endangering jobs associated with, for example, blast furnaces, welding assembly lines and

paint shops. And of even greater importance for production planners, is the fact that industrial robots not only generally work better and cheaper than human workers, but they make it possible for the first time in mass production to replace the efficient but inflexible, fully-mechanized transfer assembly lines by production systems having greater flexibility.

A manipulator which spot welds in an auto factory--unlike the case of conveyor assembly lines previously used when production volume was sufficiently large--can weld the bodies of various models in whatever order they come down the line. For example, starting next Fall, two- as well as three-door bodies of the Model-3 will be robot-welded at BMW. The robot has the proper program stored for each variant; as a result, production can be quickly and accurately tailored to the particular order. Also, in the case of an extensive model change the robot only has to be reprogrammed while, in the past, fully automated assembly lines had to be scrapped in such cases. A fixed welding conveyor line designed to make 90 to 100 percent of the required spot welds on a given body design cannot usually be economically reconfigured to produce a different style body.

Percentagewise, the auto industry is the greatest user of robots in the FRG, presently employing about 1,680 of the probable 3,300 manipulators. As recently as December 1981, the Fraunhofer Institute for Production Engineering and Automation (IPA) in Stuttgart had estimated the total number at 2,300. The sudden increase came from the gigantic investment effort for building more energy efficient automobiles which brought the iron-collar workers into the factories literally by the hundreds. The build-up is taking place not just at BMW which placed an order for 125 robots with the Iwka subsidiary Keller + Knappich (Kuka) for use in Model-3 production. Also Daimler-Benz has built up the number of its robots from 100 in 1981 to presently just under 300, primarily for use on the new "small" Mercedes 190. Ford is presently employing about 250; last year the number was barely 100. VW and Audi together employ 804; the number was 621 at the end of 1981. At Opel about 40 manipulators are at work; Porsche, the smallest domestic auto maker, still does not have any.

Also, the auto industry has played the dominant role in developing manipulators. Following the prototype American industry which began building the first robots in the 1960's, German auto firms began to use programmable manipulators for the first time at the beginning of the past decade, mainly for difficult welding jobs. VW became a robot manufacturer itself and has in the meantime put together in its factories the largest robot army in the FRG.

Future Industry

Robots in German industry do more welding than anything else. Of the nearly 1,400 automats which--according to IPA's count at the beginning of this year--handled tools, over 770 were used for spot welding and barely 240 for path welding. In third place came the "painters", machines which paint or, for example, in the auto industry apply protective coatings to the underside of the chassis. Of the 880 robots which handle parts, the function of machine loading and unloading ranked in first place with about 375 units followed by pressure and injection molding with 113 robots.

According to IPA's latest estimate, about 6,000 industrial robots are installed in all Europe and about 7,000 in the United States. The Japanese have, using the German definition of "robot", probably 8,500 of the iron-collar workers. Compared to the total number of installed machines and the number of human workers operating them, industrial robots are to be sure still a tiny minority. However, in line with all expectations, the industrial robot is standing at the very beginning of a highly promising future. As early as 1985, according to IPA estimates, at least 4,000 to 5,000 robots will be working in German factories. Worldwide, during the next 5 years, their number will increase from today's 21,500 to about 50,000.

New Professions

Volkswagen, the largest German robot maker, has until now produced only for its own use; however, since Spring it has had a license agreement with the American concern General Electric which permits G.E. to manufacture and distribute VW robots. In addition to VW there is in the FRG still a good half-dozen other companies which produce industrial robots. Among these are Siemens and Bosch; the Zahnradfabrik, Friedrichshafen; the Felss Brothers Tool and Machine Factories; Fibro and the Augsburg company Keller + Knappich (Kuka) which specializes in welding robots. In the domestic as well as the world market, these manufacturers compete with very much larger companies, some of which have been in the business much longer. These include the Swedish electrical concern ASEA; Norway's Trallfa; America's Unimation and Cincinatti Milacron, the two largest robot manufacturers in the world; and Japan's leaders Kawasaki Heavy Industries and Fujitsu.

To date, German manufacturers have not earned much money from building robots. For one thing, the cost of developing the highly complicated equipment has been immense; for another,the market has not yet materialized. In 1980, even in the midst of staging for the onslaught of the iron stachanovites, barely 500 new robots were installed in the FRG; in 1981, all said and one, the number was about 1,050. Thus the entire domestic market volume was no larger than the sales of a better medium-sized machine tool factory. However, if growth projections are on target, the German robot pioneers will surely be able to convert their high investment costs into cash.

With the rapid advance of the robots onto the shop floor, their job-killing effect of course multiplies. An IPA expert estimates that 1 robot displaces 1.5 to 2 human workers. At present, building and installing robots still creates more jobs than it eliminates in the FRG; however, even he knows that this favorable labor-market fact will not be true beyond some point in the future where the effect will reverse. Then it will be easy to project the gloomy picture of robots as job killers.

At BMW it has been recognized that with the application of robots hard-labor jobs can be replaced by tasks such as controlling, monitoring, tuning and servicing machine installations. The man on the welding arc will be completely replaced by robots in chassis building, and it is generally agreed that this worker should be retrained and upgraded if possible since the demand for such higher qualified workers is increasing. In accordance with the model

"hybrid technician" the company is attempting to expand the employees' mechanical knowledge and then in a sec-course to impart fundamental electro-technical and electronic knowledge. Following the model "manufacturing mechanic" or "production mechanic", skilled workers will be trained who, in the fully automatic manufacturing operation, will take over inspection work, make small repairs, accomplish planned maintenance and generally be responsible for the smooth flow of production and targeted quality.

Capability Still Lacking

The unions--especially the one most affected until now, IG Metall--have to date viewed industrial robots primarily as a new potential for humanizing the workplace. But with experience, the view is jelling that robots increase unemployment since with their help productivity increases faster than production. The former DGB Chairman Vetter predicted last year with warning overtones that by 1986 between 25,000 and 30,000 robots would be working in domestic industry. The latest worrisome projection of IG Metall is that by the end of the 1980's, at least 40,000 robots will be roboting in German factories and will have driven out 200,000 to 300,000 workers.

It is assumed in these projections that the robots, which presently cost between DM 30,000 and 350,000 each and which will require an equal investment in infrastructure and interfacing equipment, will become cheaper as the number of units increases and, even more important, that they will get much smarter. It is believed that their electronic controls can still be made much cheaper and that their efficiency can be greatly increased by means of optical and tactile sensors. The great development goal in this regard is to provide industrial robots with the capability to pick a part from a bin of jumbled parts and thereby make it suitable for work at a conveyor belt, that is make it suitable for assembly work which until now has been so labor and consequently wage intensive. As of now, none of the 2,300 robots working in the FRG can pick a part on the basis of size or location. They all lack the faculty of intelligent orientation and therewith the associated flexibility which are readily provided by the eye of the human worker.

According to IPA the format still does not exist for industrial robots to become job killers on a grand scale. In addition, when the investment boom in the auto industry is over, the demand for programmable manipulators will slow down even if new uses are coming on line. Once before, at the beginning of the 1970's, there was a robotics euphoria which was followed by a big collapse during the recession of 1974 and 1975. Above all, however, IPA sees robotics not so much as competition for human workers but rather as a follow-on generation for special machines in the class of fully automated assembly lines. Since very few people are left on these, robots could not displace human workers in great numbers.

Job Killers?

How dangerous robots will actually become to human workers probably depends on how smart their designers make them and on how successful the designers are in developing optical and tactile sensors. If engineers could provide their

automats with the flawless ability of "bin grabbing", then production chiefs in industry would only need to have their products redesigned for robotic assembly and the exodus of man from the factory floor would begin. The road to there is of course still long. The optical sensors contained in a TV camera and one or two TV monitors give advanced robots the capability to make a simple "table grab". On the other hand a successful "bin grab" into a jumble of parts will--even if it has already been accomplished in the laboratory--from the standpoint of the hard reality of the factory floor have to remain on the wish list of the robot fathers for a few more years. And according to an IPA expert: It will never be technically and economically feasible to reproduce the human mind in robots.

But already with what they can do today and with what they can almost surely be taught in the foreseeable future, industrial robots will have additional good employment opportunities at BMW. The automation of production on the scale of that of BMW is economically reasonable and therefore possible with programmable manipulators alone: fully automated, embedded welding conveyor lines for bodies can only be considered for production exceeding 1,000 parts per day. Thus, by 1986 BMW will increase the number of its robots to about 460; within 10 years this number will be increased to about 720.

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CSO: 3698/109

BMW: FULLY FLEXIBLE WELDING FOR PASSENGER-CAR UNDERBODIES

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 14 Dec 82 p 5

[Text] At BWM's Munich plant the first fully flexible welding transfer lane for passenger car underbodies was put into operation last August. In the facility for the new BMW model series 3, multipoint welding tools and twelve standing and fourteen portal-industrial robots are welding the underbodies of the car body together. For the first time this system of flexible production has been implemented on a larger scale by Kuka Schweissanlagen & Roboter GmbH, Kuka reports.

In the new assembly line "Underbody" for the series-3, the flexible technology has been used on this scale for the first time, according to Kuka. Smaller production units, e.g. for wheel housings and sidewalls, have been in operation at BMW for some time. In all, the company is using more than 120 Kuka industrial robots of the IR 601/60 and IR 200 models.

The flexible welding line for the underbodies of the BMW series-3 is divided into four sections. In the first section, the rear assembly is stitched, and then in two stations each with two standing robots Kuka IR 601/60 and one portal robot Kuka IR 250/500, this assembly is welded shut. In order not to restrict the flexibility of the section--which is based primarily on the use of robots--a new system for multipoint welding tools was developed. The master tools can be changed by pushing them out to the side, likewise the lower copper rods which are replaced in the lower floor with the table dropped. Thus, firstly, production losses due to defects or due to required maintenance to the multipoint welding tools are avoided, and secondly, the production of different models in the mix is possible.

Whereas the standing robots are equipped with welding tools, the portal robots weld with Picker electrodes against lower copper rods which are also lowered and replaced to the side. The base plate on the front (between front and rear assembly) and the front

end are welded in separate areas parallel with the production of the rear assembly. For the base plate, Kuka installed two rotary-table units so that four portal robots IR 250/500 each weld the plates on the two rotary tables. The front end is joined in a conventional welding unit and a standing robot welds the last points.

In the second section of the flexible line, the front-end base plate, front, rear assembly and rear cover-plate are stitched by a multipoint tool. The stitched underbodies are then divided to two parallel-operating welding lines and every second underbody runs under the first welding section to the second end-welding section. Due to this arrangement, the down-times needed for transport within the line are reduced considerably, which contributes to the adherence to a 53-second cycle time, Kuka reports. In addition, the desired welding repitition is thereby achieved.

The two lines are each divided into three stations. In station 1, two portal robots are welding, in stations 2 and 3, two standing robots and two portal robots are working. The finished underbodies from the first end-welding line are carried off on the second line. BMW and Kuka place particular value on the repititive nature of this facility. For instance, the robots working on rear-end assembly can take over the tasks of any failed unit. If a station in one of the two welding lines fails, then all underbodies are closed by the other welding line. Within the processing sections, "Shuttles" provide transport for the assemblies.

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CSO: 3698/139

BRIEFS

FRANCO-JAPANESE CARBON FIBERS--The Carbon Fibers Company (SOFICAR) was officially created on 8 December; 65 percent of its stock is held by ELF [French Gas and Lubricants] and 35 percent by the Japanese group Toray. Mr Robert Rager, assistant manager of ELF's chemical division is chairman of the board. Negotiations between Toray and ELF started in 1980. A protocol agreement was signed in May 1981. It was followed by a final agreement, signed last September. In a first stage, SOFICAR will sell Toray fibers imported from Japan. Late in 1984, in a 3,000 tons/year plant located near Lacq, it will start producing fibers from an imported raw material (polyacrylonitrile); 200 jobs will be created from the start. When the market warrants it, SOFICAR will manufacture the basic raw material and double its plant capacity. Carbon fibers are a new material which finds many applications in the aeronautics and space industry. The world market is estimated at 1,500 tons/year, including 250 tons in Europe (and 100 million in France). The creation of this company demonstrates that ELF's carbon fiber project is progressing on schedule. A competing project is now under development by Pechiney-Ugine-Kuhlmann and the American company Hercules. They have just started construction on a 200 tons/year plant at Pont-de-Claix, near Grenoble. [Text] [Paris AFP SCIENCES in French 16 Dec 82 p 51] 9294

CSO: 3698/146

SCIENCE POLICY

FIRST PROJECTS OF NEW INDUSTRIAL RESEARCH PROGRAM BEGIN

Paris L'USINE NOUVELLE in French 6 Jan 83 pp 44-50

[Article by Marc Chabreuil and Pierre Virolleaud: "New Industrial Research: First Projects"]

> [Text] After a year of reflection and structural reforms, the new applied research programs are being started. The procedures are unusual and require the expertise of many. But the first projects are already taking shape. Most of them are directly involved with industry.

Regional meetings and national symposium, programmation and orientation law, mission reports: for research, a year of reflection and self-examination has just ended. In 1983, it will go into action. However, although the law now defines very clearly the spirit in which applied research contracts will be awarded and the organization that will manage them, the various stages through which the new structures are to be set in motion are not yet completed in all sectors.

The DGRST [General Directorate for Scientific and Technical Research] is dead, long live the DGRT [General Directorate for Research and Technology]!, one is tempted to write. Things are not that simple. Actually, the old DGRST has been replaced by a three-headed organization:

- The Scientific and Technical Mission (MST) is in charge of scientific and technical instruction and follow-up. The mission is chaired by Robert Chaball and headed by Yves Farges. Its departments roughly cover the same disciplines as the former DGRST committees.

- The Directorate for Scientific and Technological Development and Innovation (DESTI), with its director, Maurice Allegre, is in charge of relations with industrial enterprises and other ministries. It is the one which brings into play incentive credits. It also manages ANVAR [National Agency for the Valorization of Research].

- The Directorate for General Policy, headed by Jean-Francois Thery, will define the main lines of the scientific research policy, develop plans and distribute budget allocations.

This is how Yves Farges summarizes this organization: "We have seen to it that power is no longer in the hands of just one [organization], but divided among scientists, users and administrators."

The second major innovation introduced by the programmation law is that now people are considering one program at a time, i.e. they are trying to mobilize the various research partners for well-defined operations extending over a limited period of time. 1985 or 1986 is the deadline for most of the operations already defined. The Administration now chooses its artners instead of issuing invitations to tender as in the case of concerted action contracts (although these have not been abolished). The organization of programs is based on the same "cross-logic" which calls for three authorities. Some, the larger ones, are mobilization programs, others are dedicated programs (and may in time turn into mobilization programs), but all are managed by teams with different backgrounds. As an additional precaution, decisions on some programs will have to be submitted to a national committee including, in particular, representatives of all the ministries concerned, as well as scientists, industrialists, union representatives, etc.

Obviously, such an organization--which drastically changes administrative routine--cannot be implemented overnight. The present status of mobilization programs can be summarized as follows: the respective missions appointed during the first half of 1982 have all submitted their report to the minister. Most national committees have been appointed. Their deliberations will take place during the first half of 1983.

Programs Do Not All Progress At the Same Pace

However, things are not that much dependent on administrative reorganization. Thank god, industrial research goes on, working and thinking about new objectives. This is why we did not wish to wait any longer to disclose to you the major outlines of the new French industrial research.

Our description is far from exhaustive since programs are not progressing all at the same pace (for instance, the chemistry commission report is still in the hands of Jean-Pierre Chevenement). And even if they were all published, these incentive operations should not for all that make us forget that research is also carried out by private enterprises, that ANVAR is providing incentives for development, and that large public organizations such as CNRS [National Center for Scientific Research], CEA [Atomic Energy Commission], INSERM [National Institute for Health and Medical Research], INRA [French Institute for Agronomical Research], etc., also have their own programs which decidedly stress valorization.

Incentives

When means are discussed, what comes to mind is of course financial aid: it is provided by the research fund (Ministry of Research and Industry credits) and by the budget research allocation (common funds from other ministries). A total of 13 billion francs would be set aside for mobilization and dedicated programs. But other means of action besides financial means are available to

DRGT. If need be, it may arrange for the creation of public interest groups (GIPs) or simply associate partners around a theme. Above all, it has the right to review the research programs of large organizations and sees in that right its major orientation tool.

Four Research Categories and Their Budgets

The orientation and programmation law voted last summer distinguishes four civilian research categories. For each of them, we have indicated between parentheses the amount provided for in the 1983 budget:

- Basic research (7.8 billion francs).

- Major technological development programs (8.1 billion): nuclear power plants, space, civilian aeronautics, oceans and marine technology.

- Mobilization programs (8.6 billion): rational use of energy, biotechnologies, electronics, cooperation and the Third World, employment and working conditions, scientific and technical education and promotion of the French language, technological development of the industrial fabric.

- Dedicated programs (4.5 billion): robotics and machine-tools, mechanics, materials, chemistry, biomedical engineering, scientific instruments, drugs, engineering, wood industry, land transportation, automobile, steel-making, textile, underground resources.

Electronics: Two Projects Beyond the Evaluation Stage

"Making choices is not enough. We must also consider the capabilities and knowhow of public and private laboratories, and then see if the orientations chosen fit in with the strategies of the enterprises involved, which are guided by market constraints and by their ability to implement the orientations chosen," Francois Levieux, secretary of the electronics action plan, told us.

Such a consensus is arrived at in two stages. The first is an evaluation by a group of experts; it takes at least two to three months and ends up with the preparation of detailed specifications. Then, after government organizations (Technical Coordination Committee on Electronics, Interministerial Committee on Electronics and National Committee on Electronics) have confirmed that these specifications are consistent with the electronics industry as a whole, the project is effectively started.

The project must lead to the realization of a prototype suitable for industrialization or of a service corresponding to a large or strategic potential market.

This structure is unwieldy, which explains why this mobilization program--the largest at industrial level with the energy program--will actually start only this year. Out of eight national priority projects selected, only two have already gone beyond the evaluation stage:

- Displays: it involves a components project (flat-faced screens, etc.) and a display system project, and could fit in small and medium-sized enterprises in connection with the "image research" mission.

- Very large scale integration (VLSI) computer-aided design. Two projects on work-stations are about to be launched and the creation of "silicon brokers" encouraged. This is a "customer service" that will enable companies which do not have their own development means to obtain complex circuits, even in very small quantities. Intermediates of this type, which may offer technical advice or merely centralize orders, already exist in the United States and in several European countries.

The evaluation of two other priority projects is about to be completed: consumer electronics and electronic modules for mini and micro-computers. Evaluation on the last four preselected themes (computer-aided instruction, computer-aided manufacturing, computer-aided translation and software engineering/artificial intelligence) should be completed by the end of the first quarter.

This mobilization program, which is supported by organizations such as CNRS, INRIA [National Institute of Data Processing and Automation Research], ADI [Data Processing Agency], CEA and INRA, and by manufacturers such as Thomson, CII-Honeywell-Bull and CGE [General Electric Company], as well as by smaller enterprises (especially for software) will require a total of 6-8 billion francs in investments, depending on the projects selected.

Materials: Short-Term and Long-Term Strategy

"The materials dedicated program is the only one with a dual structure: the Materials Committee for the short and medium-term management of themes recognized as important, and the Orientation and Reflection Committee (COR) for the definition of priority lines of action along which our country must be represented in the long term," Jean-Francois Gobin, its secretary, told us.

In the immediate future, to take advantage of expertise on basic materials in making major technological decisions, 11 themes were selected. Four are cross-sectional: cold-plasma surface treatments, ionic implantation, laser, etc.; behavior laws and reliability of solid materials (effect of mechanical stresses, temperature, radiation, etc.); thermomechanical treatments for semifinished products; pilot production processes and energy savings in glass, aluminum and steel-making. Civilian laboratories working under national defense contracts, among others, will provide assistance. Five additional specific themes focus on strategic materials:

- Composites: for fiber-type materials, research will involve matrices, oiling (fiber-matrix binding), automated implementation and non-destructive control, and will take the form of ANVAR invitations to tender or concerted operations. Also, the notion of composite materials will be defined more accurately by an interministerial group.

- Ceramics: new grades for mechanical applications (engines and turbo-machines) and for piezo-electric and electronic applications will be developed.

- Single-crystal amorphous alloys to be used in glass and metallic materials. These are for instance amorphous cast iron filaments to be used as reinforcement for various materials (cement, etc.) or in the realization of effective magnetic armor. Other types of amorphous alloys with yet undreamt-of potentials will be developed. These activities would be centered especially around Saint-Gobain and CNRS.

- Technical polymers: these high-value-added materials with promising applications (biometariels, electronics, bonding, etc.) will be developed.

- III-V components [as published], which will form the basis of the future electronics industry: gallium arsenide (AsGa) in particular appears to have a promising future. Final choices will depend on the options selected for the electronics sector.

These efforts, which will also involve wood and new housing materials, will be supported at industrial level by PUK [Pechiney-Ugine-Kuhlmann], Saint-Gobain, CDF-Chemistry [French Coal Board], Usinor and Sacilor. Traditional materials (glass, steel and aluminum) which offer considerable development potential will not be neglected and research will be intensified on these materials (high yield strength sheetmetal for deep-stamping to be used in automobiles, new aluminum alloys for aircraft, etc.) as well as on their implementation (automation, process-energy savings, cost reduction, etc.).

Energy: Fulfilling 1990 Savings Objectives

"In view of the involvement of the French Agency for Energy Expertise (AFME), the mobilization program for rational energy production and use and energy diversification enjoys a special status, which will be determined early this year," Philippe Chartier, AFME scientific director and chairman of the energy mission, told us. His mission has just produced this program and determined the Agency's research and development orientations... Apart from coal conversion, which is the responsability of CODETEC [expansion unknown], and raw material savings questions, which are not included in the energy program, AFME and the mobilization program have identical objectives.

If we except basic research, AFME has chosen two major orientations for its efforts: on the one hand, the emergence of new technologies, including both upstream research on subjects with potential spin-offs and experimental pilots; on the other hand, programs aimed at optimizing existing technologies. The first orientation will involve six sectors and be supported by public (CNRS, CEA, INRA, BRGM [Bureau of Geological and Mining Exploration], CNEXO [National Center for the Exploitation of the Oceans], ONERA [National Office for Aerospace Studies and Research], etc.), collective (CETIM [Mechanical Industries Technical Center], CETIAT [expansion unknown], IFP [French Oil Institute], CSTB [expansion unknown], etc.), and industrial (Bertin, EDF-GDF [French Electric Company-French Gas Company], CDG, CGE, PUK, Saint-Gobain, etc.) research orgarizations; these sectors are as follows:

- Thermics, mechanics, thermodynamics: this operation will essentially be supported by schools. Research carried out at Central School, UTC [expansion unknown], the Douai School of Mines, the Poitiers university, should lead to the optimization of heat generators, new engines, reliable and inexpensive windmills, etc. The Agency would also like to organize students' training periods to "inject grey matter" into neglected fields (energy savings in industrial buildings, etc.).

- Chemical engineering: energy savings are possible in this sector which will be affected by the availability of alternate fuels.

- Biological engineering: this sector, which is related to biomass problems, solar biotechnology and alternate fuels, will lead to substantial energy savings, especially in the agrifood sector. In addition, the solar energy direct bioconversion program (CEA, CNRS, AFME, CFP, Elf, Rhone-Poulenc, and soon the Lyons Water-Supply Company) will be continued in Cadarache; its objective is to use algae to obtain high-value-added products in the short term and fuels in the medium or long term.

- Quantic conversion of solar energy: this project deals with photochemistry, solid-state physics, photon-matter interactions, etc.

- Deep-rock geothermy: heat extraction from dry rock, a poorly mastered technique, represents a major economic potential.

- Electrochemical storage: a promising theme for the Agency, which is primarily interested in reassessing its theoretical potential.

As far as technological programs are concerned, five operations have been decided. Their objective is to comply with the energy savings objectives set by the government for 1990. "These objectives cannot be fulfilled with present technologies," Philippe Chartier stated. They include:

- Low-temperature heat in homes: heat generators (increased boiler and heat pump efficiency, use of vegetal waste and fuels), heat-supply networks and short-term heat storage.

- Average to high-temperature heat for the industry: according to the Agency, energy savings will be easily achieved, the problem being mainly a financial one for enterprises. Technically, this operation will probably result in an ANVAR invitation to tender concerning components (single-phase and two-phase exchangers, power generators, heat effluent valorization, heat pumps and mechanical steam compression), control systems (sensors, systems optimization, etc.) as well as drying and water-elimination concentration processes.

- Rational use of electricity in homes and in the industry, the objective being to save primary energy: this operation will involve both known products (improvement in the efficiency of furnaces, condensers, transformers, lamps, etc.) and the development of new processes (mechanical steam compression, membrane processes, etc.).

- Centralized energy production: photovoltaic energy using silicon (Rhone-Poulenc, Photowatt, Elf, Leroy-Somer, France Photon, etc.) and amorphous silicon (Saint-Gobain), biomass (alternate fuels, air gasification and methanation), heliothermy (testing and evaluating existing facilities until 1985), micro-hydraulics (a few realizations in France and inventory of potential), energy from the sea (with CNEXO as project director), and 100-500 kW windmills, which will be the subject of intensified efforts in 1984. This, of course, is aimed at developing countries and the rural areas of industrialized countries; some of these technologies also have a long-term development potential in France.

- Transportation: study of road transportation problems (energy-efficient cars, new engines, advanced aerodynamics with Renault and Peugeot), and alternate fuels.

To carry out these publicly financed operations, aimed at a "market which should be captured by the national industry and lead to the reconquest of the domestic market," the Agency will take an interest in standardization and regulation questions. In addition, it will strengthen its metrology-testing department; this step is indispensable in order to draw a precise balance of past operations and assess technologies and teams. At the same time, it intends to modify its present statistical and planning tools and its models to promote the concept of energy savings in France. "For the energy accounting methods now in use exclude this factor!," Philippe Chartier stated.

Metrology: Considerable Industrial Assets

Oriented toward development rather than research, and guided only by basic laboratory and industrial requirements, the scientific instrument industry falls into the category of priority programs. According to DRGT mission delegate Robert Berthoumieux, this sector is on the eve of recovery. Actually, it does not lack competent enterprises which, given some aid and some regrouping, could soon form a strong industry.

In scientific optics, companies like Soro (of the CGE group), Quantel and Sopra are in an excellent position. Already an optical network leader, Jobin-Yvon could soon become a leader in emission spectrometry. In sectors like absorption spectrometry, X-ray analysis and electronic microscopy--in which we are nonentities at world level although we do not lack technical competence--operations of three types are contemplated:

- To aid existing small and medium-sized enterprises achieve quick growth.

- To arrange for balanced agreements with foreign companies.

- To obtain licenses to manufacture in France.

France, for instance, is practically absent from the field of hyperfrequency measurements. Yet, the development of satellite communications and optical fiber networks, and military applications lead to expect an explosion of the market. This is why the Ministry of Defense and the Ministry of Posts and

Telecommunications have joined the Ministry of Research and Industry in giving out contracts likely to help enterprises design materials conforming with international standards. Their objective is ambitious: out of reputable firms like Giga Instrumentation, Tekelec, Enertec and Adret, they want to build a spectrum analyzer, filter and hyperfrequency generator industry offering a line of products that could compete with that of the U.S. giant Hewlett-Packard by 1985-1990.

Another slot remains unoccupied: that of plant management. No manufacturer has yet imposed its data processing standards in this field, although enterprises like CGEE[General Electrical Equipment Company]-Alsthom and Schlumberger are well placed. Selection of a bus type, realization of VLSI circuit interfaces, development of a universal operating system: such is the overall plan which, by 1984, should bring the introduction of the first comprehensive plant management system, a system that could impose French standards on future competitors.

Because of their technological diversity and multiple applications, sensors deserve a long-term effort. The operations undertaken extend over several years, some of them up to 10 years. The whole sensor component industry must be built or rebuilt. Two examples: microelectronics-based ionosensitive sensors which will require French manufacturers to resume producing special glass for pH measurements, and selective gas sensors for which no industrial scheme has been set up yet.

Other operations of a lesser scope aim at reducing the cost of existing sensors rather than at developing new products. Thus, Lyon-Alemand-Louyot has carried out research on thin platinum layers and is about to market a thermometer probe that will cost 10 times less. Another example is that of rotational displacement transducers used in particular in industrial robots: research and manufacturing methods and optical-coder miniaturization will make it possible to cut prices by one half or two thirds by 1984.

As a whole, to the 20 or so concerted operations initiated since 1977 by DGRST, the measuring instrument program has added some 30 voluntary operations.

Biotechnologies: A Long-Term Effort

"We have the roots, we have the leaves, we lack the trunk." According to Gilbert Durand, secretary of the biotechnology-expansion mobilization program, the roots are basic research which, in France, is of high quality. The leaves are the manufacturers who are ready to manufacture products. The trunk is the long work which consists in picking out of basic research all that can be valorized. On this side of the Atlantic, this is not a routine job.

Besides, considering the slow progress of the usual development processes in this discipline (it takes up to 10 years of testing before marketing a drug), a boom of new products cannot be expected for next year! Therefore, Gilbert Durand's concern is to strengthen existing teams so they can undertake long-term operations. Rather than a scattering of many concerted operations, they prefer initiating program agreements with large organizations (INSERM, INRA,

Pasteur Institute, universities) or again reinforcing thematic operations programmed by CNRS.

Another type of intervention consists in carrying out projects on one theme with one person in charge, several interested laboratories, one program and one budget. One such research project dealing with microbial polyoses is about to start; it will involve five or six laboratories specialized respectively in strain research, structure study, property identification, utilization (food lines, oil recovery, textile fibers, etc.).

Finally, a third type of operation is contemplated: aid to manufacturers wishing to reinforce or create their research team.

The mobilization program revolves around five major research themes: microbiology, fermentation, enzymology and enzymatic engineering, genetic engineering, vegetal cells.

Along with these scientific disciplines, two major projects will be pursued and should provide logistic support to biotechnologies as a whole. One involves the creation, this year, of a national (and soon European) data bank on nucleic acid sequences which users will access through terminals. The other is a longer term project and involves the centralization of existing organism strain collections at the Pasteur Institute.

Biological and Medical Engineering: Choices To Be Made

As a result of DGRST's efforts since 1978, no less than 700 projects supported by contracts were introduced at the Biological and Medical Engineering Conference last October in Toulouse. "At first, considering the diversity of this sector, we had to open the game," Jean-Claude Bisconte explains. "There are now over 100 themes, compared with only about 10 five years ago." However, the time has come to make choices. Of the 700 projects, some 40 should be retained. This is why the first task of the dedicated biological and medical engineering program is a rigorous assessement of this project, from a technical, chemical and economic point of view, in close connection with the Ministry of Health. Already, four major pilot projects have been started.

- The first one deals with nuclear magnetic resonance (NMR), a method using non-radioactive protons which, in the long term, is expected to replace conventional radiology and X-ray scanners on the imagery market (2 billion dollars in the U.S. in 1983). Whereas over 20 manufacturers are already offering equipment of this type in the United States, the first experimental instruments of the General Radiology Company (CGR) are expected to be introduced this year. But a new NMR generation, named Topical Magnetic Resonance and using phosphorus spectroscopy, is in the works. And CEA, CNRS, INSERM, together with CGR, will do all they can to make sure that we are better placed for this second round, which will not reach the commercial stage for another five years.

- At the instigation of Prof Francois Gros of the Pasteur Institute, a second major project was started last year. It deals with two-dimensional electro-

phoresis and involves the study of particles through their migration under the effect of an electric field. With this process, it is possible to record, at a given time and on a single plate, a veritable complex identity card of a biological matter, for instance blood. The development of such a machine will still require many efforts in fields as varied as automation, miniaturization, standardization of receiver plates, image processing, form recognition, etc. No series production is contemplated in the next four or five years.

- Bioreagents also offer a wide scope for research. The offspring of biotechnologies, they will make possible more refined medical analyses, using simplified instruments and, above all, using much less reagent. This operation was started early this year and could find its first markets very soon, in close connection with the biotechnology expansion program.

- On the biomaterials market, the objective of using new technologies to regain the position now occupied by the Americans is not a utopia. Two major orientations, in which French research is already well engaged, will be pursued: that of memocompatible materials (for parts coming in contact with blood): these are polymers on which precious materials are grafted; and that of carbon-carbon materials, a spin-off from the aerospace industry, which are used for valves, articulation and ligament prostheses, etc. Among the industrial partners, we should mention Rhone-Poulenc and CEA for the former, SEP [European Propellent Company] and Carbone-Lorraine for the latter.

Mechanics: Priority to Lasers and Surface Treatments

"What is the major handicap of the mechanics industry? Unquestionably, it is its poor image," Gilbert Payan, secretary of the dedicated mechanics program, told us. Thus, with the help of MIDIST [Interministerial Mission on Scientific and Technical Information] and the Mechanical Industries Federation (FIMTM), he is preparing the launching of a veritable promotion operation, including on television. "Like in the United States, Germany of Japan, the best students must turn toward mechanics," Gilbert Payan said; he is also contemplating a reorganization of the school system, starting in high schools, and will rely on IUTs [University Institutes of Technology]. In future classes, mechanics will be much more closely associated to electronics and data processing. At the same time, research will receive new impetus, with aid from CNRS, CEA, the Welding Institute, the Central Technical Armament Institute, etc.

The mechanics program provides for a reinforcement of existing means: improvement of the technical level of small and medium-size enterprises (thanks to a seventh mobilization program, for the technological development of the industrial fabric, and probably with aid from large public enterprises), increased efforts to regionalize technical centers (especially CETIM [Mechanical Industries Technical Center], regrouping of learned societies and promotion of research contractors (like Bertin, Metravib and HEF [Hydromechanics and Abrasion of Saint-Etienne]).

Apart from robotics-related products and hydraulic, pneumatic and hydro-pneumatic engines, two major objectives have been set: on the one hand, lasers and the optical controls (spectroscopy, etc.) that would be used with them; on the

other hand, surface treatment. For the latter, the effort undertaken last year on cold plasmas will be continued and intensified.

In the field of lasers, four research and industrialization orientations have been selected:

- Laser sources properly speaking, with support from, among others, CILAS [Laser Industrial Company], Laser Techniques and CEA, which uses them to demolish nuclear power plants.

- Special machinery, the development of which is limited by the inertia of mechanical parts (use of composite materials), the velocity of electric motors and the power of control computers. For example, Laser Techniques just delivered to Redel, an automotive subcontractor, a five-axis machine to cut out instrument panels (three axes for the part, two for the laser). "In many cases, however, productivity increases can be achieved with simpler equipment," Gilbert Payan pointed out.

- The creation of small and medium-size subcontractors equipped with two or three lasers, as in the United States. One such company was created two months ago in the Limoges area, but "the market is large enough to leave room for another 10 or so."

- The diffusion of information on laser applications: this obviously includes welding and cutting, but also hardening, surface treatments and direct alloy production.

Some of these operations could be supported by the "laser club" created a few months ago and managed by CETIM; it includes manufacturers, technical centers, universities, CNRS and CEA. Already, cooperation agreements have been signed and research undertaken on the laser-matter light interactions.

Productics: A More Industrial Orientation For the ARA Program

"Automation in the service of production," this is how Jean-Francois Le Maitre, a Renault engineer delegated to MST and secretary of the dedicated productics program, defines what is one of Jean-Pierre Chevenement's favorite words. Therefore, this operation, which could become a mobilization program, is not restricted to robotics. It includes programmable controllers, numerical control machines, flexible workshops, measuring machines, etc. Most of these themes were developed by DGRST after 1968 but, at the time, they were restricted to manufacturing industries. In close connection with MST's dedicated materials and mechanics programs and the mobilization programs for the technological development of the industrial fabric, electronics, and research on employment and the improvement of working conditions, the productics theme revolves around seven major operations:

- The ARA [Advanced Automation and Robitics] program which, for the time being, has mainly contributed to the development of "general" research. In the next two years, MST is planning to orient it increasingly toward production, so as to enable manufacturers to make maximum use of the results obtained. A typical

example is the experimental flexible workshop of ENSET [National Advanced School for Technical Education] in Cachan. Since this workshop is already equipped with three numerical-control machine-tools and three robots, manufacturers can use it, starting early this year, for life-size testing of their new equipment or software.

- The AMES program (Automation and Economic and Social Mutations). An expert committee was created in 1982 to study the effects of productics on employment, regional policy, international and national strategies.

- Research projects on motors and actuators, involving invitations to tender. These will involve in particular digitized axes (motor-sensor-processing assemblies); the objective is to obtain more rapid and more precise closed-loop controlled mechanisms and at the same time to decrease their price by a factor of three.

- Development of control systems for continued processing including, among other things, software research with the collaboration of ADI (metrology aids, defect detection, etc.).

- An automation and production quality project, the conditions of which have not yet been fully defined.

- The development of regional poles of expertise including at the same time laboratories, training centers and manufacturers. They would be like those in Besancon, Lyons, Grenoble, Toulouse, etc., and should go beyond regional markets and acquire national if not international competence.

- Incentives to the creation of innovative enterprises by researchers. During the past two years, five such robotics enterprises were created. This number should soon double.

However, according to Jean-Francois Le Maitre, "the results of this dedicated program will largely depend on the government's industrial policy and on the decisions that will be made concerning the three industrial robotics poles: Renault, MATRA [Mechanics, Aviation and Traction Company] and CGE."

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CSO: 3698/170

SCIENCE POLICY

FRG GOVERNMENT R&D SUBSIDIES TO BE CUT

Frankfurt/Main FRANKFURTER ALLGEMEINE in German 14 Dec 82 p 13

[Article by K.B.: "Riesenhuber Cuts Research Funds--Government Support is Intended to be a Stimulus, Not a Subsidy"]

[Text] Bonn, 13 December--The 1983 budget provides that about 900 out of 4,500 industrial research projects which presently have grants from the Ministry of Researdh and Technology will be cut by a total of about DM 430 million. Last Monday Research Minister Riesenhuber made an announcement to that effect. Riesenhuberwants to avoid cancellation of research projects. However, said Riesenhuber, negotiations must take place with the industrial recipients of these grants with a view to reducing government grants for ongoing projects. Bearing a greater share of R&D costs can not only be expected of the enterprises concerned, he said; it is indeed necessary. Grants have in some cases become so large, he continued, that they now amount to virtual subsidies. Governmental encouragement for research should be a stimulus for research activities, rather than outright support. Supplementary funds must not be so large that in the final analysis research projects are initiated strictly because government funding is available rather than because they show promise from a scientific and economic standpoint.

Riesenhuber wants to curtail supplementary research funds for certain projects not only because of a shortage of funds, but for the sake of principle. The state, he says, must not pretend to know best what is needed by the economy and by science w9en participatingin funding individual projects. The new FRG Government, he maintains, has confidence in the researchers' resourcefulness and industry's initiative. They should be encouraged with as little bureaucracy as possible.

The following will not be reduced in the 1983 research budget:

--The overall financial program for basic research and for major research installations;

--in research within industry grants, projects in biotechnology, microelectronics (including the special program designed to speed up the application of electronic components);

--space research;

--disposal of spent nuclear fuel rods;

--uranium enrichment; and,

--coal gasification.

Cuts will primarily affect new projects. Nevertheless, indicates Riesenhuber, grants will be made for new projects "at a reasonable level."

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CSO: 3698/138

TRANSPORTATION

AEROSPATIALE, AERITALIA ATR 42 PROJECT REVIEWED

Gelsenkirchen AEROKURIER in German Dec 82 pp 1356-1357, 1360-1361

[Article by Rolf Doerpinghaus]

> [Text] ATR42 is the name of a new airliner for regional air transportation which is being developed jointly by Aerospatiale and Aeritalia through a newly-founded affiliate (ATR--Avions de Transport Regional [Regional Transport Aircraft]). With this new airliner, the ATR Consortium is aiming above all at the rapidly growing regional traffic volume. ATR wants to counter the competition, which has flared up in this new aircraft category, with the help of the most modern technology involving a two-man cockpit, resembling the Airbus and including advanced aerodynamics. On the whole, Airbus know-how was employed where possible in order to give the ATR42 everything that demanding airlines want today. The highly-modern Pratt & Whitney-PW120 engines are also to ensure high economy in consumption, low noise development, and favorable operating costs. Interest in the ATR42--one can say today--is by no means confined to typical regional airlines. Even national carriers have indicated their interest, with Finnair being just one example of such a customer. Upon its appearance on the market, the ATR42 however will encounter stiff competition. Here we might mention above all the EMB-120 Brasilia, the SAAB Fairchild 340, as well as the de Havilland Canada Dash 8, with the latter coming closest to the ATR42 in terms of critical data.

As happens so often in production cooperation programs, two separate programs are responsible for the ATR42, that is, the AIT 230 of Aeritalia and the AS 35 of French Aerospatiale. During the study phase, which both companies launched independently of each other around 1978, mutual contacts aroused interest in production cooperation. In July 1980, the effort had progressed sufficiently far: both enterprises agreed to coordinate their plans with each other and to set up a joint study group to investigate the market opportunities of an aircraft for regional air transport with 40-50 seats; they also decided to develop this aircraft then within the framework of a

joint program. By the end of the year, the results of the surveys and market studies covering more than 110 airline companies on the second and third levels were available. The result was surprising: The majority of the airlines questioned wanted a transport aircraft with about 40-45 seats, with a certain stretch potential, in order to be able to meet the expected increase in regional air traffic also without changing the basic model.

At the June 1981 Paris Air Show, Aerospatiale and Aeritalia already displayed the cabin mockup on a scale of 1:1 which had been developed in record time. The cabin's dimensioning and the seat arrangement with 2 + 2 seats generally aroused much interest because it so to speak introduced an airline standard into an aircraft category of which it had been assumed until now that somewhat tight seating and space conditions as well as laborious passenger movement in the center aisle would be unavoidable.

At the time of that Paris Air Show however there was another important decision. Both partner companies--which in the meantime had gotten together to form the ATR Consortium--selected the PW 120 turboprop engine which was being developed by Pratt & Whithney Aircraft of Canada as the engine for the new regional airliner--an engine designed according to the most modern discoveries which however contains the entire experience of the PT6 family and which, from its very design onward, must be considered extremely sturdy and easy to maintain.

Although considerable competition had in the meantime arisen on the regional transport aircraft market, the ATR company consortium was able already late in the autumn of 1981 to report more than 50 orders for the new airliner--backed up by down-payments.

On the basis of these orders, both companies then agreed to start the program officially on 29 October 1981. At the same time, the general deadline plan for further program development was also drafted. This plan calls for the first prototypes to roll out in June 1984, with the first flight scheduled for August 1984 and the model licensing based on JAR 25 or FAR 25 anticipated already by the third quarter of 1985. At the end of that same year, the first ATR42 aircraft are to be delivered to the airline companies.

As modern as possible, as conventional as necessary--that is the formula to which one can boil down the philosophy behind the new ATR42, an aircraft in which designers decided to do without any spectactular technological advances but in which the most modern technology is used where this seems indicated for the sake of economy. A stretched-out, clearly organized fuselage and a wing assembly with a high degree of stretch, equipped with a modern profile and a comparatively simple flap system--these are designed to guarantee low resistance and thus also low fuel consumption. There was no experimenting with the air frame either. The fuselage and the wing assembly are made of metal whereby of course extensive use was made of glueing connections. Composite [sandwich] materials are used only in secondary structures.

If we are to believe the designers at Aerospatiale and Aeritalia, the design for the ATR42 so to speak took shape all by itself. Both partner companies agreed that only a high-wing design could be considered for an aircraft in this

category. The low clearance height of the fuselage above the ground, the simple landing gear design, and the possibilities for using large, slowly rotating air screws--these were powerful arguments in favor of the high wing solution. Naturally, the companies did not from the very beginning want to rule out the possibility of being able to offer the ATR42--in spite of its primarily civilian purpose--also for military transport missions with a modified tail assembly and possibly a big loading ramp.

The aircraft's dimensioning sprang above all from two general conditions: The number of passengers which was specified at between 42 and a maximum of 49 seats and the determination of the maximum range at full occupation with 700 nm (1,300 km). This range requirement sprang from the desire to be able to fly at least four line segments of 100 nm, each, with this aircraft without refuelling. A considerably greater range did not seem necessary on the other hand also because aircraft in this category would hardly be considered for flying times of 3 hours and more.

Cabin

Transport aircraft today are built around the cabin. The main advantage of the ATR42 over competing models would appear to be its relatively large-dimensioned fuselage volume which, with comfortable 32-in seat intervals, offers room for 42 persons or 46 persons at 30-in seat interval, or perhaps even 49 passengers with reduced baggage compartment.

The basic philosophy actually was to give the passenger in the ATR42 more room than in any competing model. Past experience showed that the airlines had little interest in offering this kind of passenger luxury and, where possible, decided for a closer seating pattern. The solution seems rather unusual at first sight. Passenger baggage and freight are in a single compartment between the cockpit and the passenger cabin. The passengers enter the aircraft, not as was to be expected, through a door behind the cockpit, but through an entrance on the left rear of the fuselage.

If we look around the cabin, the ATR42 need not fear any comparison to a "full-grown" airliner in terms of passenger perspective. The passenger will find every comfort here, including enough room to stretch out and sufficiently large hand luggage shelves above the seats, such as we have become accustomed to them in present-day jet liners.

A factor in dimensioning the cabin was the idea of being able to use the ATR42 possibly for freight transportation whereby the cabin dimensions had to be adjusted to the presently customary LD3 containers. In the so-called quick-change version--with an additional large freight loading door as well as hand luggage shelves in the cabin which can be folded away to the side and the corresponding rolling rails on the cabin floor--the ATR42 at any rate can take up five LD3 containers. It thus fits homogeneously into present-day airline air traffic, something which is all the more significant because the future of regional air traffic above all must be seen in a supplementation of the existing airline network.

Cockpit

Toulouse is considered the center of modern cockpit technology. An almost revolutionary development was launched here for the FFCC for the Airbus. There was question for Aerospatiale and Aeritalia that the ATR42 would also get a flightdeck patterned along the lines of the new Airbus cockpit. And the great expenditure is certainly justified because in the typical short runs, which are characteristic of this category, the important thing is to reduce the crew's work load to a minimum in order to allow enough time for air space observation, radio traffic, etc. We must likewise not fail to mention the big front windshields which promise optimum visibility conditions for the crew.

Engines

The new Pratt & Whithey-PW120 turboprop engine is still being developed; it is considered to be the most advanced and the most economical engine in this performance category. For the ATR42, the engines with 1,700 kw (2,277 shp) standard output are being cut back to 1,343 kw (1,300 shp). Huge, four-bladed propellers (3.96 m diameter) by Hamilton Standard will provide good efficiency at low rpm and thus reduced noise emission. Another factor that was important in the selection of the PW120 was its great performance reserve (safety margin in case of single-engine flight). The entire fuel (maximum 4,500 kg) is carried in two integral tanks in the wing assembly.

Systems

In terms of the systems, the ATR42 has been designed in as simple a fashion as possible. The pressurized cabin is supplied with engine tap air. At 6 psi (0.41 bar) maximum differential pressure, it is possible at a flying altitude of 25,000 ft to maintain a cabine pressure corresponding to 6,500 ft (1,980 m). Two independent hydraulic circuits supply the landing gear, the flaps, the spoilers, as well as the nose wheel steering.

Landing Gear

To facilitate a continuing unrestricted fuselage profile, the landing gear was arranged in lateral fuselage gondolas. An additional advantage here was the greater wheel gauge which naturally also makes easier to handle the aircraft.

Performances

The table below presents an overview of ATR42 performance figures. Here it is interesting to note that runway lengths of less than 1,000 m are supposed to be enough. The comparatively fast cruising speed of 277 kn (513 km/hr) makes for short blocking times which does not make the speed difference compared to jet travel appear to be too great. The ferrying range has been given at 2,800 nm (5,185 km) with 29 passengers on board, the ATR 42 can achieve a range of 1,400 nm (2,590 km), which undercores the flexibility of this aircraft.

For a typical 100-nm run, the statistics are 278 kg as block consumption and a travel time of 32 minutes while, for a 200-nm run, the block consumption is 450 kg and the travel time would be 54 minutes. Figures comparing this aircraft to the presently available models are particularly spectacular. Compared to a much-flown turboprop, with an annual transport performance of 200,000 passengers over a distance of 100 nm, the ATR42 yields a fuel saving of 278 t.

Outlook. Aerospatiale and Aeritalia have launched an aircraft project in the form of the ATR42 which, so to speak, overlaps into the market areas of regional and airline air traffic. The time for such an aircraft was certainly long overdue and one might ask oneself why the market leader in this aircraft category, the Fokker Aircraft Works, refrained from pursuing the follow-on aircraft for the F27 with its future plans until the competition with typical Dutch reserve was bound to recognize a challenge for action here.

Aerospatiale and Aeritalia accepted the challenge in the form of the ATR42. But trying to describe this aircraft merely as a successor to the F27 would mean misinterpreting the opportunities residing in this project.

If it really turns out possible to keep the operating costs of such aircraft within the projected limits, then this aircraft will probably contribute greatly to the opening of markets for air transportation which today are still closed to it for cost reasons, to the benefit of regional transportation, but also to the benefit of airline traffic because both will have their chances for further growth above all through mutual supplementation.

That only leaves us with the hope that the transportation policy makers will also recognize the opportunities springing from technological advancement in aviation and will not through artificial and bureaucratic obstacles try to restrict the possibilities emerging from technological progress before they can prove their value to the infrastructure of a modern industrial society. It would be a shame to use the generation of new regional airliners now under development, including the ATR42, only for the Third World.

[continued on next page]

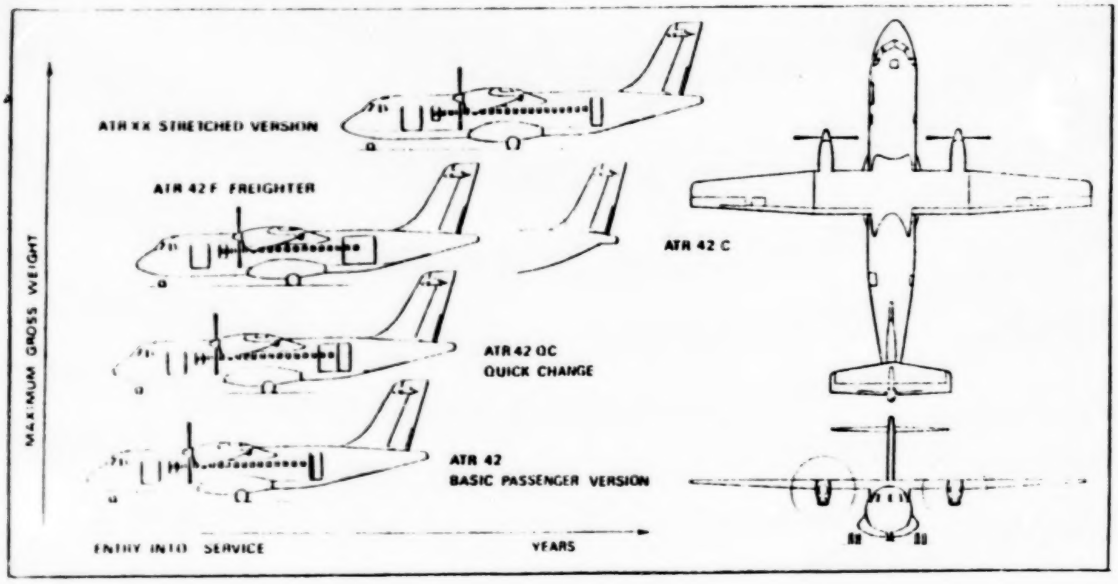
Statistics on ATR42

Maker		ATR (Aerospatiale Aeritalia)
Model		ATR42
Engine maker		Pratt & Whithney Aircraft of Canada
Engine model		PW 120
Output	kw	2x1,343 = 2,686
	shp	2x1,800 = 3,600
Dimensions		
Length	m	22.69
Wing span	m	24.57
Height	m	7.58
Cabin		
Length	m	13.8
Width (maximum)	m	2.57
Height	m	1.91
Volume	m^3	44.80
Freight and baggage compartment		
(forward)	m^3	5.8
(rear)	m^3	2.7
Hand luggage shelves	m^3	1.6

		ATR 42-100	ATR 42-200
Crew + passengers		2 + 42	2 + 46 to 49
Weight of equipment and accessories	kg	9,480	9,560
Maximum fuel		4,500	4,500
Maximum weight without fuel (MZFW)	kg	14,500	14,500
Maximum payload	kg	5,420	6,900
Maximum takeoff weight	kg	14 [illegible]	15,750
Maximum landing weight	kg	14,900	15,500
Maximum speed	kn	250	250
	Mach	0.55	0.55
Maximum cruising speed	kn	276	275
	km/h	511	509

[Continued next page]

At altitude	ft	20,000	20,00
	m	6,100	6,100
Service ceiling	ft	25,000	
	m	7,620	
Single-engine	ft	10,450	
	m	3,185	
Takeoff run	m	960	1,080
Landing run	m	920	960
Block fuel consumption over 100 NM	kg	273	276
Range with full passenger complement	NM	700	950
	km	1,300	1,760



Family planning in the ATR program. The program is designed so flexibly that, in addition to the currently planned ATRA42 100 and 200 versions, it will also be possible to build a stretch version, designated ATR XX, in case the corresponding engines are available.

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